THE PREVALENCE OF DRUG THERAPY IN COMMUNITY-BASED AND INSTITUTIONALISED ELDERLY PERSONS

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A thesis

submitted in partial fulfilment

of the requirements for the Degree

of

Master of Arts in Psychology

University of Canterbury

1987

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ABSTRACT

This was a survey of 1273 institutionalised and non-institutionalised elderly persons living in a city area. The sample was drawn from rest homes, residential homes, private hospitals, district nursing clients and pensioner housing units in Christchurch. Collectively these organisations represent a large proportion of elderly in this city. A comprehensive summary of current medications for each subject was obtained. A variety of demographic data, information on medication compliance, and adverse reactions were collected. Factors that hinder rational drug therapy, repeat and PRN (as required) prescription, and factors that promote rational use, placebos and drug-free days were measured. The mean number of drugs prescribed was 3.4. Psychoactive drugs were precribed to 29.1%, cardiovascular to 26.8%, and analgesics to 12.8% of the sample. Factors that indicated rational or irrational drug therapy varied across level of residence. Differences existed in use of night sedation and psychotropic drugs with more used in institutional care. There was great within residential level difference. These results were discussed with respect to other surveys and explanations were offered to account for differences in drug therapy use.

ACKNOWLEDGEMENTS

I wish to thank my supervisor, Dr. N.N. Singh for his guidance, advice and encouragement during the writing of this thesis.

I am grateful for the support of the Nurse Maude District Nursing Association, for the time and interest shown this study. Sincere thanks also to the nurses, matrons and owners of the rest homes, residential homes and private hospitals who gave so freely of their time.

I thank all the elderly of Christchurch who made this study possible, I was privileged to meet you.

Special thanks to Gaye Marshall for her assistance and friendship. I thank also Leon Bakker, and Kevin Moesbergen who helped with the statistics for this thesis.

To my Family, Jim, Jackie, and Paul, your continual support, encouragement and practical help was trully appreciated.

CHAPTER I

INTRODUCTION

The elderly, those aged 65 and over, are a very important group in society yet until recently have been paid scant attention. The World Health Organisation (1980) estimated that by the year 2030, 52 million people or 17% of the population of the United States of America will be aged 65 years or more and will be responsible for consuming 40% of the total national drug budget. O'Malley, Judge and Crooks (1976) reported that in the United Kingdom the elderly constitute 12% of the population and account for 30% of the drug expenditure.

In New Zealand, 14% of the population was classified as elderly in 1981. Of the public health vote in 1979/1980 the elderly consumed 30%, a major part of this was for medical and pharmaceutical services. It has been forecast that this proportion will rise to 15% by the year 2001. In New Zealand the reason for this rise is a falling birth rate, static immigration, and an improvement in social, economic and medical conditions that prolong life. There is also a trend for the proportion of this population that is very old to be increasing. In 1951 only 8.6% of the population over 60 were 80 or more; by 1981 it

increased to 11.8% and the estimate for the year 2001 is 13.3%. While the life expectancy for men has not increased significantly since 1930, there has been a significant increase for non-Maori women. A woman now aged 80 can expect to live 1.4 years longer, which is 24% longer than in 1930. For 82.2% of the over 65's this can mean a longer life of enjoyment, since those in this age group are still functionally able. As 44% of the very old are disabled, for many it will mean a longer period of life dependent on others for care.

The proportion of the very old population is forecast to peak in 20 years time, and at this time, there will be fewer in the workforce to support them. It is predicted that there will be fewer married elderly and therefore there will be an increase in the number of elderly living alone, without the support currently supplied by a spouse. The proportion of elderly living in institutions may increase or more community help may be provided than is presently available. Of those over 80 years, 80% live in their own homes until they die or until near-death.

Admission to residential care is often inappropriate and is made at a time of stress for reasons of need for security and support after a major life crisis, a bereavement, or through pressure from family, and results in a loss of independence which is treasured by the community elderly. Appropriate criteria for admission is a level of

frailty that prevents a person managing at home, even with domicillary services. Although the majority of homes provide a high standard of physical care, social and mental needs are just as important. A Health Department report (1982) suggested that there was a serious misplacement problem in some residential homes and one in three residents should have a change in accomodation: 9% to private accomodation, 15% to pensioner housing and 9% for long-stay geriatric care.

Only 6.2% of the elderly live in institutions. Of these 2.8% live in residential homes, 2.6% live in private and public hospitals, and 0.9% live in mental hospitals. Of the 2.8%, religious and welfare agencies accomodate 63%, private profit making groups accomodate 29%, and hospital boards run homes for 8%. There has been an increase in numbers in institutions but the rate of increase is slowing.

The most common home size is 10-20 residents. There are a few small homes catering for fewer than five and a few very large homes catering for more than 100. The large homes are run by religious and welfare groups and the residents tend to be the least disabled. Residents of old peoples homes tend to be very old, widowed and female. One third are disabled, a third slightly disabled, and a third not disabled. Time spent in an institution varies; 31% stay for less than a year, 48% between one and five years, and 21% for more

than five years (Census Report, 1981).

Lake (1974) surveyed the elderly in New Zealand and of those living in the community 91.3% lived in private accomodation, while 2.5% lived in pensioner housing. Pensioner housing was found to be used by the most needy, especially those with few assets. The residents were older, more disabled and women out numbered men five to one.

CHAPTER II

LITERATURE REVIEW

1. DRUG PRESCRIBING PATTERNS.

(1) Hospital

Drug prescibing patterns for the elderly vary considerably in different parts of the world. Lawson and Jick (1976) have reported data collected by the Boston Collaborative Drug Surveillance Program (BCDSP). A consistent finding was that elderly patients in North American hospitals are prescribed more drugs than those admitted to European, Middle Eastern or Australasian hospitals. The average number of medications prescibed to United States inpatient elderly populations is 9.1, to Canadians 7.1, to Iraelis 6.3, to New Zealanders 5.8 and to Scottish 4.6.

Bergman and Wiholm (1981) reported a Swedish study of 285 consecutive admissions of the elderly to hospitals and reported that the average number of drugs prescribed for them was 3.7. The most common drug class was cardiovascular, followed by psychotropics.

(2) Community

A study by Chein, Townsend and Townsend-Ross

(1978) examined the drug prescriptions for 242 ambulatory community-based subjects aged over 60. Two or more drugs were prescribed to 83%, 14% were on 7-15 drugs, while only 8% were on no drugs. The most common drug classes were analgesics (66.6%), cardiovascular (33.5%), laxatives (30.6%), vitamins (29.3%), antacids (26.4%), and antianxiety agents (22.3%). It was found that 60% were prescriptions and 40% were over the counter (OTC) drugs.

Guttman (1978) reported that 62% of a sample of 447 elderly persons used prescribed drugs, 33% were on between 2-4 drugs, and 5% were on 5-9 drugs. The most used drug class was cardiovascular (39.3%), followed by sedatives and tranquilisers (13.6%), antiarthritic preparations (9.4%), and gastrointestinal drugs (11.4%). Sixty-nine percent of the sample used OTC drugs, analgesics (55.4%), vitamins (8.1%), and laxatives (7.1%).

As part of a screening programme, May, Stewart, Hale and Marks (1979) reviewed 3,192 geriatric persons. The average number of drugs used was 3.2, with higher use of both prescibed and OTC drugs for women. All the commonly prescribed drugs were for chronic ailments and were not curative. The number of drugs used increased with age. Five of the top 25 drugs were sedative-hypnotic drugs.

Hale, Marks and Stewart (1979) ran a screening

programme for the over 65's to detect hypertension and other disorders. From a sample of 1711, 76% regularly used a drug. A consistent increase in the average number of drug categories used was seen with increasing age. By age 85, more than 85% were using at least one drug regularly. Men used an average of 1.7 drugs compared to 2.0 drugs for women. The most commonly used classes of drugs were antihypertensive agents (30.7%), vitamins (26.7%),cardiac drugs (15.3%), cardiovascular dilators (12.7%), laxatives (9.1%), and tranquilisers (8.7%).

Dawson (1980) surveyed 99 patients over the age of 65 from a G.P practice in Sussex. Only 11% did not use drugs. Of the drugs prescribed diuretics were taken by 30%, laxatives by 30%, and analgesics and antipyretics by 27% (including OTC drugs.). Hypnotics accounted for 16% of the prescriptions.

In three community-based samples, Reinken, Sparrow and Campbell (1982) examined the levels of compliance to psychotropic drug prescription in New Zealand. One sample involved 559 elderly, with 37.5% being prescribed a psychotrophic drug. Benzodiazepines was the class most commonly prescribed. Compliance was poor, with 40% not taking their medication as prescribed but the direction was, for the majority, a reduction in dosage. Tricyclics were also commonly prescribed, usually to older subjects who showed much better compliance. Overall only 4% were prescribed

phenothiazines but they were more commonly prescribed to those who were institutionalised (14% were receiving a major tranquiliser).

In another New Zealand study Barrett (1978) surveyed 53 elderly pensioner housing residents for compliance to medication. Of the sample 90.6% were taking medication prescribed by a doctor; of the 9.4% who were not, three of the five were taking OTC drugs. An average of 4.8 drugs per person was being taken. The range of drugs prescribed was 0-10.

(3) Long Term Care Institutions

A study by Bergman (1975) looked at the drugs prescribed to 106 patients in a nursing home. The resident's average age was 78.7 years and 80% of them were women. The average number of diseases each patient was treated for was 2.4. The most frequently diagnosed diseases were cardiovascular and Central Nervous System (CNS) disorders. The average number of drugs prescribed was 7.2 per patient. It was found that many drugs were not prescribed correctly, were not proven effective, and were not reviewed adequately.

Kalchthaler, Coccaro and Lichtiger (1977) investigated the incidence of polypharmacy in a 200 bed long-term care facility. In a random sample of 100 patients, the average number of drugs prescribed was 3.33. Of the 100 patients 73% were receiving at least

three drugs daily, 44% were on at least four drugs daily, and 22% were on at least five drugs daily. The most frequently prescribed drug class was analgesics followed by antihypertensives, cardiotonic drugs and antimicrobials. Sixty one percent of all patients were receiving psychotropics. Haloperidol was the most commonly prescribed major tranquiliser and diazepam was the most common minor tranquiliser. Flurazepam was the most common sephoric agent. Two patients had more than one major tranquiliser prescribed, three patients had both minor and major tranquilisers, and 13 had prescriptions for sephoric agents as well as a major or minor tranquiliser.

Ingman, Lawson, Pierpaoli and Blake (1975) observed 131 patients in an extended care facility, with special regard to neuroleptic use. The subjects were drawn from three areas of care. The first were severely brain damaged, the second group were ambulatory and capable of self-care, and the third group were maximally disabled or recently discharged from hospital. The most prescribed drug classes were analgesics and minor tranquilisers. The authors were concerned with the high number of drugs prescibed on a discretionary basis (pro re nata; PRN), which left nurses unclear as to the physician's instructions, and also a "renew " instruction which resulted in the accumulation of drug prescriptions often initiated several months or even a year before. This also meant patients were on multiple

drugs of similar pharmacologic action. There was also a tendency towards the prescription of more neuroactive substances for those patients showing higher mental capabilities and independence. The average number of non-neuroleptic drugs prescribed was 2.5. The most common were laxatives, cardiac drugs, diuretics, and oral hypoglycemic agents or insulin.

In a study which investigated the effects a consultant pharmacist had on prescribing practice, Cooper and Bagwell (1976) found that it resulted in a 19.4% reduction of drugs prescribed. Of these there was a reduction of 45.9% of PRN drugs; an overall reduction from 7.22 to 4.78 drugs per patient (33.8% decrease). The subjects were drawn from a 116-bed skilled nursing facility.

A study by Ray, Federspiel and Schaffner (1980) concentrated on the prescription of psychotropic drugs in nursing homes. They examined the prescriptions for 5,902 patients living continuously for a year in one of 173 Tennessee nursing homes. Each subject was matched with an ambulatory person. Of those in the nursing homes, 97% received prescriptions (on average 67 per person) when compared to 71% in the comparison group (an average of 30 per person). As nursing home size increased more drugs per patient were prescribed. For those in nursing homes 74% were prescribed CNS drugs, yet only 36% in the comparison group received them.

Antipsychotics were the most frequently prescribed CNS drug for the nursing home patients yet these were infrequently prescribed for the comparison group. Forty three percent of nursing home patients were prescribed antipsychotic drugs, the most frequent being thioridazine, chlorpromazine and haloperidol.

In a study of anticholinergics in a nursing home, Seifert, Jamieson and Gardner (1983) found 34.5% of the confused elderly were receiving drugs; the predominant classes were antidepressants or antipsychotics. The authors thought important the fact that 75% of the confused patients received the drug with the most anticholinergic activity for its class, as this may increase the risk of or exacerbate existing confusion.

Patterns of neuroleptic use in nursing homes, geriatric, psychogeriatric, and general hospital wards in a London Borough were examined by Gilleard, Morgan and Wade (1983). Their sample of 839 patients was representative of all institutionalised within the Borough. Thirteen percent had received a neuroleptic within the preceding 24 hours. Within the hospital high usage was associated with the psychogeriatric wards, with no use in the rehabilitation wards. Generally there was higher use in the long stay units than in the short term or assessment units. The usage in the homes did not differ significantly from the hospitals but there was high within home variation.

The studies presented here are varied in their methodologies, their terminologies, the populations surveyed, their emphasis - that is whether all drugs are surveyed or just psychotropics, but in general there appears to be a concensus on high drug usage, which increased with age. Also, there appears to be more usage of psychotropic drugs in the institutionalised elderly.

2. PHARMACOKINETICS

Pharmacokinetics is concerned with absorption, distribution, metabolism and elimination of drugs and how, whether young or old, sick or healthy the body affects drugs (Laurence & Bennett,1980).

There have been many studies of pharmacokinetic changes in the elderly and there are considerable number of excellent reviews (Bliss, 1981; Crooks et al, 1976; Lamy, 1978; Reidenberg, 1980; Richey & Bender, 1977; Triggs & Nation, 1975; Vestal et al, 1975; Vestal,1978,1980). Thus, only a brief summary is presented here.

(1) Absorption

Most drugs are absorbed by a process of passive diffusion and this function does not vary significantly with ageing (Greenblatt, 1983; Lamy, 1982; Reidenberg 1980). A few drugs, vitamins (thiamine), carbohydrates

(galactose), calcium, and iron are absorbed by an active transport mechanism which does appear to decrease in function with age (Crooks et al, 1976; Thompson, 1983). However there are changes in the gastrointestinal system in the elderly which influence absorption such as motility, increased pH, levels of gastric acids, reduction in absorbing cells, and reduced splanchnic blood flow (Abrams, 1985).

For example metroclopramide speeds gastric emptying while drugs with an anticholinergic activity slow gastric emptying, with the resulting change in motility influencing absorption (Reidenberg, 1982). Digoxin is absorbed by passive absorption but it is dependent on pH, thus there can be a reduction in the availability of the drug. In addition one drug may interfere with the absorption of another. For example the extent of propranolol absorption increases with age while absorption of chlordiazepoxide decreases. Also changes in food intake (malnutrition) can vary drug transit times.

(2) Distribution

After absorption a drug must be distributed around the body. The elderly show changes in body size, tending to be smaller than younger adults, with a decrease in muscle tissue. This is especially true for women. There is also a change in body composition; whereas overall weight may remain constant, the ratio

of lean body weight to fat changes with age. Total body water decreases by 10-15%, giving a smaller volume of distribution for water soluble drugs and thus a higher concentration of drug per unit volume if the dose is left unaltered. The lean body weight decreases while the increase in fatty tissue is as much as 10-20%. Drugs that are lipid soluble have an increased volume of distribution and therefore have a prolonged effect.

Distribution of drugs is measured by examining the binding to macromolecules in tissues and in the blood, such as albumin. Plasma albumin levels also decline with age for several reasons, the most important being a reduction in synthesis. As albumin decreases the expectation would be for higher elimination rates for drugs highly plasma bound although for some drugs no change is seen while for others a decreased rate is shown. There are fewer binding sites so an increase in unbound drug fractions occur. This reduces the range between therapeutic and toxic effect for some drugs. A number of adverse reactions have been linked with reduced albumin levels. The presence of liver or renal disease will also alter the binding of drugs. With changes in albumin binding in the aged there is an increase in interactions which result in displacement of one drug with another. The more drugs present the more likely this is to happen. Higher free fractions of phenylbutazone and

salicylates have been documented (Lamy, 1982).

(3) Metabolism and Elimination

Because there is little change in absorption the elderly are at risk of overdose if pathways of drug elimination and metabolism are inefficient. This is especially so if the drugs have a narrow therapeutic index, for example digoxin, aminoglycosides, and oral hypoglycaemic agents.

Hepatic Metabolism. Drugs are metabolised by the liver to inactive or active metabolites which are excreted by the kidneys. Some drugs are excreted unchanged in the urine. Hepatic function shows considerable variation (Lamy,1982). Some elderly show reductions of one-third to two-thirds the rate of metabolism in younger adults. Individual elderly may metabolise drugs as efficiently as younger adults (Reidenberg, 1980). Clearance is unpredictable and depends on metabolic pathway, gender, smoking, and other agents currently being ingested (Greenblatt, 1982; Vestal, 1978).

There is evidence from work on first pass extraction and hepatic blood flow to suggest that any drug with a high extraction ratio will be eliminated more slowly and thus have a higher plasma concentration for longer, i.e., a higher steady-state plasma concentration on repeated dosage. Second pass reactions seem to be less affected by ageing.

Renal Elimination. As cardiac output diminishes blood flow to other organs is redistributed. Reduction in renal blood flow reduces clearance and drugs that are excreted unaltered accumulate.

Drugs excreted through glomerular filtration (digoxin, aminoglycosides, antimicrobials) accumulate as glomerular filtration rate decreases up to 50% in the elderly. A quantitative approach to measuring kidney function is through serum creatinine concentration. But serum creatinine production decreases with age, as well as its excretion through decreased kidney function. Creatinine clearance is a better measure of renal function.

3. PHARMACODYNAMICS

Pharmacodynamics is concerned with how drugs, alone and in combination, affect the body.

There are fewer studies in this area, many compare young healthy adults with geriatrics. Changes apparently due to ageing may be explained by concomitant disease. Co-existing disease may upset compensatory mechanisms which would usually minimise an unwanted side effect such as postural hypotension or hypothermia. There is greater sodium loss from diuretics secondary to reduced nephrons and therefore reduced ability to save sodium ions. Hypokalemia produced by thiazide diuretics lowers the dose

threshold for digitalis toxicity (Reidenberg, 1980).

Studies suggest drugs acting on the CNS have an increased effect for a given plasma concentration. For other systems, such as cardiovascular, there appears to be a decrease.

Pharmacodynamic interactions occur, for example, aminoglycoside antibiotics concurrently given with loop diuretics can produce hearing loss when the drugs are given in doses below that expected to cause deafness (Brown & Feldman, 1978). Ramsay (1981) found increased sensitivity to drugs at receptor sites with nitrazepam and warfarin. Antihypertensives with a beta-blocker effect have decreased effect in the elderly.

There needs to be more study done in this area. The elderly differ in the quantity of drug presented to a target organ (pharmacokinetics) and also in the sensitivity of that organ to the drug (pharmacodynamics). But despite this, drugs are taken by the elderly in similar doses to the young and there are very few drugs with recommended geriatric dosages.

4. SELF-MEDICATION

When considering the health of the elderly in terms of patterns of drug use, drug interactions, and adverse reactions it is essential to be aware of the high usage of non-prescribed drugs and preparations (Over the Counter, OTC, drugs). The range of preparations available are immense and range from herbal or "natural" remedies to vitamins, laxatives, analgesics, antihistamines and other traditional medicines.

A report by Michocki (1982) lists analgesics as the most used class of OTC, followed by antacids, laxatives and vitamins. The concern with high use of analgesics is that there may be a masking of a serious disorder. Also many analgesics contain aspirin which has been linked with many adverse reactions such as gastrointestinal complaints. Chronic use of low dose aspirin can cause anaemia secondary to gastrointestinal bleeding. Uric acid retention from analgesic doses can cause exacerbation of gouty arthritis. Salicylate toxicity, developed through repeated dose and increased half-life, causing the drug to accumulate, has the following symptoms: dizziness, tinnitus, nausea, vomiting, diarrhea, and mental confusion. These symptoms, according to Michocki (1982), can be

inappropriately ascribed to old age. Lamy (1982) states that aspirin with other drugs can contribute to hypothermia and asthmatic patients can develop idiosyncratic reactions that are particularly dangerous.

Antacid used for "indigestion" or "heartburn" may indicate ischemic heart disease and may delay appropriate treatment. Sodium bicarbonate based antacids may cause sodium overload exacerbating congestive heart failure and hypertension. Calcium based preparations can cause hypercalemia and constipation. Aluminium compounds cause constipation, magnesium salts can cause diarrhea resulting in fluid and electrolyte depletion. Gerbino and Gans (1982) state that aluminium salts have been implicated with the development of dementia in uremic elderly. The electrolyte depletion caused by magnesium salts, especially of potassium, is important for patients being treated with digitalis glycosides who may show digoxin toxicity. Antacids cause reduced absorption of other drugs,(e.g., iron, tetracyclines, cimetidine and digoxin). Antacids interfere with elimination when they cause a change in gastric or urinary pH.

Laxatives are used by half of all elderly and the consumption increases with age. Michocki (1982) quotes figures from U.S. Government statistics showing that in skilled nursing homes 15% of all prescriptions are for laxatives. More than 58% of all residents use

them and a large percentage receive more than one (40%). Stimulant and lubricant laxatives should be avoided because of inhibition of fat-soluble vitamin absorption, abdominal pain, diarrhea and electrolyte disturbances.

If taken in excess the fat-soluble vitamins (i.e.,A,D,E,K) can cause toxicity. However, most diets should provide the necessary vitamins without supplement but this may not always be the case in the elderly.

Gerbino (1982) has suggested that alcohol is a potent OTC drug which is often overlooked or ignored as unimportant. However, it has a potent CNS depressant effect and can cause serious interactions with other CNS depressants. Examples are benzodiazepines, barbiturates, muscle relaxants, antihistamines and psychotropic agents. Other drugs which should not be taken together with alcohol include analgesics (including narcotics and aspirin), anticoagulants and other cardiovascular drugs (digitalis glycosides, diuretics, antihypertensives, and antiarrhythmics), and antidiabetic agents.

McGlone (1980) has suggested that because our culture is medication orientated, we accept through media exposure that OTC drugs are safe in any circumstance. There is no scientific evidence to support this when people consume drugs at doses which are not recommended by the manufacturer.

5. COMPLIANCE

For the purposes of this review compliance is restricted to drug therapy but includes both conscious and unconscious changes to drug treatment. Non-compliance includes failure to take drugs at certain times, interruption of treatment, error in doses, drug taking at incorrect intervals and the addition of drugs.

The World Health Organisation report (1980) states that over 1000 articles and meetings have been devoted to the area. The rate of non-compliance varies from 25 to 59%. Advancing age by itself does not appear to be a significant factor but polypharmacy, memory impairment and visual impairment are important factors.

An interesting study by Mazzullo, Lasagna, and Griner (1974) asked 67 patients to interpret instructions on ten prescription labels. Not once was a label uniformly described by all subjects. There was variability in interpretation of imprecise instructions but also frequent misinterpretation of explicitly described instructions. The authors suggested there was a need to link instructions to the daily living patterns of the patients.

A study by Hulka, Cassel, Kupper and Burdette

(1976) involved 357 patients of 46 physicians. There were four types of errors: omissions (19%), commissions (19%), scheduling misconceptions (17%) and scheduling non-compliance (3%). The combined average error was 58%. The more drugs prescribed the more errors of omission and commission were made. The greater the complexity of scheduling the greater the errors of commission and scheduling misconceptions. If the patient did not understand the function of all his or her medication then errors of commission and scheduling misconception increased.

Dunbar and Agras (1980) report that there are no personality factors or social factors that reliably indicate compliance nor is motivation a reliable factor. However understanding of the drug regimen by the patient is more important than knowledge of the disease process.

In a study involving 111 elderly living in the community, Cooper, Love and Raffoul (1982) found no significant differences in psychosocial factors as to which subjects were compliant and which were not. Forty-three percent took medication in ways not indicated by the instructions. Underuse accounted for 90% of the non-compliance. Non-compliance was intentional for 73%. For these subjects it was very likely they were using more than one pharmacy and more than one physician.

If the total number of drugs taken on a regular basis is greater than three and if frequency of daily dose is more than twice daily there is considerable non-compliance in the elderly (Bergman et al,1981). Vestal (1982) suggested that aids to compliance are calendars, diaries, pill dispensers, suitable bottle caps and packaging. A policy of return and destruction of old medication would help prevent confusion. Regular review of the indications for each drug should occur at three to six months.

It is evident from the literature that compliance can be inceased if there are only a few drugs prescribed, the regimens are kept simple, there is adequate explanation of the drug regimen, written instructions are given, and good labels and special packaging are used.

6. ADVERSE REACTIONS

Early work in the area of adverse reactions to drugs in the elderly was carried out by Hurwitz and Wade (1969) and Hurwitz (1969). The findings from one hospital study showed that 118 patients from 1160 developed adverse reactions, with more patients being over 60 years, more women than men, and patients who had reactions were taking more drugs than those who did not develop adverse reactions.

An Australian study (Learoyd,1972) looked at 236 consecutive patients admitted to a psychogeriatric unit, 16% of whom presented with disorders directly attributable to the effects of psychotropic drugs. These patients were excessively sedated or confused, some had disinhibition reactions and were aggressive, agitated, restless. Others had falls and suffered fractures through hypotensive episodes. All improved on reduced or terminated medication and were able to be discharged.

Caranasos, Stewart and Cluff (1974) studied drug-induced illness leading to hospitalisation, over a three year period. Of all admissions 2.9% were drug-induced, most patients were older than 61, more white women than black women or men were involved. The drugs involved in a third of the illnesses were

aspirin, digoxin, warfarin sodium, hydrochlorothiazide, prednisone, vincristine sulfate, northindrone and furosemide. OTC's were involved in 18% of the cases. While 17.6% of the illnesses were due to drug allergy, the mechanism for the remainder was pharmacological.

A study in Edinburgh, commissioned by the British Geriatric Society, was reported by Williamson and Chopin (1980). Of 1998 patients consecutively admitted to geriatric medicine departments in England, Wales and Scotland during a one-year period, 81.3% were taking prescribed drugs on admission. Adverse reactions were found in 15.3%, implicating 312 different drugs. The average number prescribed per patient was 2.3. The incidence of adverse reactions increased with increasing number of drugs being taken. Patients on only one drug had 10.8% of the reactions, whereas 27% of those receiving six drugs had adverse reactions. The main drug groups involved were hypotensive drugs, antiparkinsonian agents, and psychotropics. The largest single number of reactions was with diuretics which were the most commonly prescribed to the sample (37.4%).

Reported in the literature by numerous authors are lists of drugs implicated in adverse reactions in the elderly. Tables 1 and 2 summarise these findings.

TABLE 1: Examples of Drugs usually given in reduced Dosage in the Elderly.

Drug	Possible consequence of standard dose regimen.
Aminoglycosides -streptomycin, -gentamicin, -amikacin	deafness, renal toxicity.
Benzodiazapines	Unwanted CNS depression, hang-over effect.
Carbamazepine	Drowsiness, ataxia
Chlormethiazole	confusion
Digoxin	Digitalis toxicity
Haloperidol	Severe extrapyramidal reaction (rare)
Levodopa	Hypotension
Metoclopramide	Confusion, Parkinsonism
Pethidine	Respiratory depression
Thioridazine	Confusion, Parkinsonism
Thyroxine	Myocardial infarction
Vitamin D	Renal toxicity(high dose)

*From several sources.

TABLE 2: Drugs with Potentially severe or unusual side effects in the elderly.

DRUG	UNWANTED EFFECT
Barbiturates	Confusion
*Bethanidine	Severe postural hypotension
Benzhexol	Visual & auditory hallucination
*Carbenoxolone	Fluid retention, CHF
Cardiac glycosides	Behavioural disorders, abdominal pain, fatigue.
*Chlorpropamide	Hypoglycaemia
Chlorpromazine	Postural hypotension, hypothermia
*Chlorthalidone	Prolonged diuresis, incontinance
*Debrisoquine	Postural hypotension
Disopyramide	Urinary retension
Emepronium bromide	Mouth & oesophageal ulceration
Ethacrynic acid	Deafness
*Guanethidine	Postural hypotension
Indomethacin	Aplastic anaemia
Isoniazid	Hepatotoxicity
Mefenamic acid	Diarrhoea
Methyldopa	Drowiness & depression
*Nitrofurantoin	Peripheral nephropathy
Oestrogens	Fluid retention, CHF
*Pentazocine	Confusion, variable efficacy
*Phenylbutazone	Aplastic anaemia
Tetracycline	Rising blood urea in the presence of impaired renal function.

*Generally avoided in the treatment of the elderly.

7. PSYCHOPHARMACOLOGY

The elderly are a diverse group but they have in common a tendency to be prescribed large numbers of drugs. These drugs have varying effects and often produce dangerous interactions with other drugs concurrently administered, adverse reactions and unpleasant side-effects. In one study, one-half of the elderly subjects using psychotropics reported they could not perform daily activities without using a drug (Katchtaler et al, 1977).

In geriatric psychopharmacology psychotropic drugs are prescribed for disordered behaviour and psychosis, depression, anxiety, and sleep disorders (Salzman,1982).

(1) Disordered Behavior and Psychosis

The neuroleptics are used for the control of hallucinations , delusions, and loose associations. In the elderly, they are more frequently used to control agitation, wandering, and aggressive behaviours. They are used also for daytime sedation and night time sleep.

The side effects, which are serious for the elderly, include sedation, orthostatic hypotension,

extrapyramidal symptoms and anticholinergic symptoms. These symptoms increase with increased dosage. Sedation, while sometimes useful therapeutically for the agitated patient and for inducing sleep, is an unwanted side effect which sometimes increases insomnia and causes confusion and disorientation in demented patients. This confusion and disorientation causes increased agitation which is often controlled by increasing the neuroleptic drug dose.

When other CNS depressant drugs (narcotics, analgesics, hypnotics) are used in combination with the sedating neuroleptic, such as chlorpromazine or thioridazine, over-sedation is most likely to occur.

Orthostatic hypotension is a common side effect which can cause falls resulting in fractures, stroke or heart attack, or a loss of confidence and independance. In a study of 100 elderly psychiatric outpatients 40% complained of dizziness and falling. About 42% were taking a phenothiazine (mainly thioridazine), 39% were taking tricyclic antidepressants and 25% were taking diuretics. All these groups of drugs are implicated in causing orthostatic hypotension. Those subjects taking three or four drugs (79%) were at great risk of developing a high degree of orthostatic hypotension.

The elderly are especially prone to extrapyramidal symptoms (Salzman, 1982). Those elderly with dementia, brain damage, or those with reduced

dopaminergic synaptic transmission (i.e., Parkinson's disease) may be more sensitive to extrapyramidal symptoms. The symptoms that cause most problems are akathisia which is often seen as agitation and results in an increase in dose. Drug-induced Parkinsonism is commonest in the over eighty year olds, drugs (especially haloperidol and fluphenazine) may aggravate tremors of old age and endogenous Parkinsonism (Thompson et al,1983; Vestal,1982).

The "Pisa Syndrome", or the flexing of the trunk to one side is another unpleasant extrapyramidal symptom. Finally akinesia is another extrapyramidal symptom which leaves the patient anergic, mute and immobile, with the face essentially blank. A sadness seen there is often interpreted as depression and antidepressants are added to the drug regime, causing increased confusion. The best treatment for these effects is a reduced dosage of neuroleptic or a change to one with less potent effects. Thioridazine has the lowest incidence of extrapyramidal effects and thus may reduce the risk of tardive dyskinesia (Thompson et al, 1983).

The neuroleptics vary in their anticholinergic properties. Anticholinergic drugs are used to reduce the severity of extrapyramidal effects, but may aggravate anticholinergic side effects produced by the neuroleptic and increase anticholinergic toxicity.

Salzman (1982) recommends a reduction in dose because of altered neuroleptic pharmacology. Thompson et al (1983) believe the long term use of anticholinergic medication is not recommended for the elderly because of the risk of tardive dyskinesia and delirium. There is a risk of tardive dyskinesia with small doses and brief neuroleptic use in the elderly (Dalziel,1982).

(2) Treatment of Depression

Thompson et al (1983) state that at any given time, 10% of the elderly population show signs of clinical depression. The difficulty is in distinguishing whether the depression is the primary disorder or a secondary disorder. Often depression is seen as a part of ageing or is misdiagnosed as dementia. There is also drug-induced depression and this cause should be suspected if the patient is receiving medications for a variety of illnesses.

MAO inhibitors are not much used with the elderly because of their high potential for toxicity. The drugs of choice are the tricyclic antidepressants. The selection of a particular drug from this response class is based on differential side effects and altered pharmacokinetics and biotransformation. Imipramine, amitriptyline, and nortriptyline show altered metabolism with higher blood plasma levels and delayed elimination (Ho & Triggs,1984).

Orthostatic hypotension is a common side effect, the potential for a drop in blood pressure is not age related but more serious for the elderly. Nortriptyline is the least likely to cause orthostatic hypotension.

Cardiac toxicity is another side effect. Anticholinergic effects are responsible for dry mouth, constipation, urinary retention, blurred vision, aggravation of glaucoma, prostatic hypertropy, delayed gastric emptying, hyperthermic reactions and sexual dysfunction. Amitriptyline is the most anticholinergic and desipramine the least of the group. Amitriptyline and doxepin are the most sedating. Desipramine and doxepin have the lowest incidence of cardiovascular effects. Tricyclic antidepressants inhibit the metabolism of neuroleptic agents and neuroleptics may inhibit the metabolism of tricyclics. There must be special care if both drug groups are used in the treatment of agitated depression.

Doses should be small to begin with, since steady state levels are slowed in the elderly and clinical effect may take up to 21 days. Tricyclics should be used with caution with volume-depleting diuretics which exacerbate orthostatic hypotension and the diuretic dose should be reduced. Extreme caution should be used if prescribing tricyclic for a patient with

cardiovascular disease (Salzman,1982).

The use of lithium is not recommended because its excretion is delayed with a prolonged half-life and toxicity is common especially if used concurrently with sodium depleting diuretics. Side effects are nausea, vomiting, tremors and confusion.

(3) Anxiety

Antianxiety drugs may be useful for acute treatment for symptoms such as worry or dread. They are not useful long term to facilitate coping with life stresses.

Benzodiazepines are the most frequently prescribed drugs for anxiety. While absorption is unchanged, there is increased target organ sensitivity and changes in distribution and elimination vary according to which drug from this class is selected. Both diazepam and chlordiazepoxide have increased half lives and active metabolites, take longer to reach a clinically useful level, have greater accumulation and take longer to eliminate. Lorazepam and oxazepam are short-acting and do not show changed pharmacokinetics.

The altered pharmacology of the benzodiazepines in the elderly results in prolonged sedation, impaired motor co-ordination, and apathy. A paper by Hoskings (1983) reports that long-term treatment is not helpful as the anxiolytic effect of these drugs builds

tolerance and results in both physical and psychological dependence.

(4) Treatment of Sleep Disorders.

A person is considered to have a sleep disorder when sleep is difficult to initiate, when sleep is difficult to maintain, and when there is a lack of feeling refreshed on awakening.

Thompson, Moran and Nies (1983) suggest that hypnotics should be prescribed for acute occurrence of insomnia, such as after a bereavement, and should be reviewed after a month. A more useful approach they suggest is research into the changing patterns of sleep in the elderly.

Salzman (1982) reported that 39% of all the hypnotics prescribed in 1977 were for those in the over 60 age group. The most commonly prescribed drug class is the benzodiazepines and in American studies flurazepam, is the most commonly prescribed drug. The side effects are commonly described as daytime drowsiness, ataxia and confusion. Toxicity is dose dependent with fewer adverse effects on lower doses.

Since temazepam and triazolam have shorter half-lifes they may be a better choice but should be used only a few nights a week to reduce the likelihood of dependence forming (Hoskings,1983). Nitrazepam, with a geriatric dose of 2.5mg (as recommended by the

manufacturers), does not appear to be used often. However, the more commonly used dose of 5mg is enough to evidence side effects. Common side effects are orthostatic hypotension and confusion. It has been suggested that nitrazepam is popular because its effect are rapid and is used in nursing homes because the old people can "switched off" with the lights (Evans & Jarvis, 1972). Williamson (1978) reported that 5mg dose of nitrazepam causes hangover effects.

While all reviews report that the use of barbiturates with the elderly is not recommended because of dependence and the risk of overdose, many authors support the use of chloral hydrate or a derivative as a useful alternative to the benzodiazepines.

THE STUDY

This study was designed to ascertain whether New Zealand showed high levels of drug prescriptions for the elderly as overseas studies have shown. The expectation was to find differences in prescribing across different residential groups, with more drugs being prescribed for those in institutions than those in the copmmunity. The level of drug prescription would be expected to rise over the levels of institution. These results would be partly due to the age structure of the groups and partly to

increasing degrees of disability.

There was also the expectation that there was high use of Over the Counter drugs, especially in the community groups. There was also the expectation that compliance would be a problem in the community as number of drugs prescribed per person increased. Finally there was the expectation that there would be high use of psychotropic drugs, with more being prescribed in institutions than in the community.

CHAPTER III

METHODS

1. SAMPLING

For this survey two samples from the population of elderly Christchurch residents were drawn. One was from elderly living in the community and the other from institutionalised elderly.

For the purpose of this study, elderly was defined as having reached the age of 65 years or more. This was consistent with most current research but differed from the World Assembly on Ageing (1982) which uses a definition of having reached the age of 60 years or more.

2. THE COMMUNITY SAMPLE

A random sample of elderly living in the community was desirable but unattainable for several reasons. The list of all superannuitants was not available from the Department of Social Welfare, nor were the electoral rolls considered fully reliable. Even with accurate lists a random or stratified sample would have been beyond the scope of this study, in

terms of time and cost.

The Canterbury Aged People's Welfare Council and the Co-ordinating Centre for Geriatric and Domicilary Services could not assist with access to a sample, so the author was very grateful to Nurse Maude District Nursing Association for their help. A senior administrator at Nurse Maude arranged for the author to travel with a different nurse each day, as the nurse completed her round. The selection of the nurse was random except that nurses required to have a student nurse present were excluded. Each day a different area of the city was covered. Thirteen of the thirty full-time nurses employed by Nurse Maude helped in the study and data were collected on 110 subjects.

Most of the patients seen by these nurses are elderly. Any household visited with any resident 65 years and over was included, that is, the patient's spouse, daughter, son, sister, brother, as well as the patient. This counters the bias towards ill-health, which was actually less of a threat to generalisation than expected as many patients had the nurse visit for non-medical reasons, e.g, to be helped in and out of the bath or to have toe nails cut.

The interview was conducted in a standard manner with each nurse introducing the author, stating the purpose of the visit, asking the patient if he or

she would consent to participate and then requesting the patient to present his or her medications. Data collection took only a few minutes and did not disrupt the nurse's routine.

Two patients refused to participate initially but after reassurance by the nurse as to the confidentiality of information given, participated. Travelling with the nurses did not disturb the elderly as door to door knocking can do. It also allowed effective use of time as the interviews had to be terminated quite quickly to allow the nurse to keep to her timetable.

The District Nursing Service is provided free of charge. This results in a wide range of elderly using the service, from those renting pensioner units to those living in luxury townhouses.

Another 60 community-based elderly were obtained from four pensioner housing schemes where the residents rent the units, and one private scheme where the residents own their units. These schemes represented different areas of Christchurch of low and high socioeconomic status. Permission to visit the private units was obtained from the agency administering the units and the residents were informed of the planned visit. It was hoped that this would allay fears; but there were thirteen refusals overall.

The interviews were extremely time consuming as many residents had been without visitors for

sometime. The interviewer returned to any unit when the resident was out the first time, so as not to bias the sample towards the less active resident.

The interviewer introduced herself and the study and asked the resident if he or she were prepared to spare half an hour answering questions. The interviewer then requested to see all medications and details were copied from the containers. A check of understanding was made after details were recorded, by holding up each container and asking:

"What is this for?".

"How often do you take it?".

Out-dated medications were also recorded and factors indicating possible non-compliance were noted. Where there were old medications, and mixed or unlabelled medications, tactful suggestionms for disposal were made.

3. THE INSTITUTIONALISED SAMPLE

Provision of long-stay institutional care is increasingly the role of private hospitals and religious homes. In 1979, 36% of long-stay beds were provided by this group. In 1981 the percentage had risen to 52 (Department of Health Report, 1982). Although providing some long-stay care, public hospital boards are involved more in assessment and rehabilitation; that is short-stay care. It was decided to concentrate on the private sector and long-stay care. However, some beds in private hospitals are subsidised by the state to provide short-stay care to give carers a rest from the responsibility of providing constant nursing care.

The sample drawn from private nursing homes and hospitals is representative of this population as a complete list of residential homes, rest homes and private hospitals was obtained. The Old People's Home Regulations (1980) requires the registration of all homes catering for more than three residents. Homes with fewer than three were not included on the list and the number in Christchurch of such homes is unknown to the author. However, there are only 25 such homes in New Zealand with a total of 79 residents catered for, so they can be safely ignored. Any listed home which lay outside Christchurch was excluded. All

other homes were contacted by telephone and invited to participate. Appointments were made for a suitable time, as soon after the call as possible, to prevent reconsideration. However, some homes did decide at the time of the visit not to participate or were unwilling or unable to give complete data. These homes were therefore classed as refusals. If a home required board approval or required that each resident's relatives and general practioner be contacted first then that home was also classed as a refusal, as it was impossible to do this in the time available.

Those homes that refused to participate present a bias but in fact many homes that did agree to participate did so with reservations and only co-operated once they were assured that other homes were also participating.

The list separates the institutions into three levels of care. The first is Residential where the resident receives full board. The second level is that of Rest Home where in addition to full board, the resident receives a varying amount of nursing care. The third is Private Hospital where full nursing care is available.

For many elderly there is a progression from level one through to level three, as general health fails. Some of the institutions, especially the religiously-based have all three levels available at

one geographic location, reducing trauma and stress of change of address.

The procedure at the institutions required gaining access to patients records. This was achieved after introducing the aims of the study to the matron, principle nurse or the owner. The confidentiality and anonymity of the clients were stressed.

The records were of varying completeness and ranged from unlocked drug cupboards containing each patients bottles of tablets, to complete charts listing all relevant data.

4. THE RESEARCH INSTRUMENT

A form was designed (see Appendix 1) to provide demographic and current drug history for each subject. The demographic information included age, sex, whether the subject lived in the community or in an institution. If institutionalised, information was gathered on level of care available and years institutionalised.

The drug information listed all currently prescribed drugs, their strength, frequency of administration, reason for prescription, adverse reactions, repeat prescriptions, and drug-free days. Over the counter drugs (OTC's) available from supermarkets and chemists were also noted, with frequency of use and dosage.

The reverse of the form (see Appendix 2),dealt with the community sample only and addressed questions such as the presence of out-dated medications and the adequacy of packaging. The resident was asked the time since last contact with G.P. or hospital clinic, whether all medications were being taken, whether OTC's were known to the G.P. and finally a check was made of patient understanding of drug regimen.

The author and one other trained interviewer undertook all the interviews. The interviews were facilitated by wearing an identification card, which carried a large photograph of the interviewer, had a brief summary of the study, and named the university as the agency involved, all written in large print. The cards were worn to all interviews.

Many of the Nurse Maude sample confused the University with the Health Department and were convinced their doctors were involved. An under reporting of OTC drug use was suspected.

5. RELIABILITY

As a check on reliability of information both interviewers were present at 27% of the Rest Home visits, 32% of Residential Home visits and 29% of the Private Hospital visits. Agreement in all cases was 100%. One interviewer copied the information as the

other interviewer observed in the majority of homes visited, the nurses were present and checked on the recordings made (as an additional check on reliability). In some homes the nurses read from the charts, which remained unavailable (for verification) to the interviewer. In a minority of homes the charts were left unattended in the interviewer's possession.

It was possible for only one interviewer to be present at the Nurse Maude visits, however the nurse generally took the opportunity to update her records and this provided a reliability check for the data collected for this study.

6. ANALYSIS OF RESULTS

Coding templates were designed to facilitate accurate coding and cross tabulation, and chi square tests and frequency tables were obtained using SPSS on the Prime.

CHAPTER IV

RESULTS

1. SAMPLE DESCRIPTION

Nine hundred and sixty three females and three hundred and ten males took part in this survey (N=1273). Of these 206 (16%) were in the age group 65-73 years, 253 (20%) in the age group 74-79, 304 (24%) in the age group 80-84, and 510 (40%) in the over 85 age group (see Fig 1). Females showed a steady increase in the percentage in each age group: 65-73, 14%; 74-79, 19%; 80-84, 24%; 85+, 43% (see Fig 2). Males were more evenly distributed: 65-73, 23%; 74-79, 23%; 80-84, 23%; 85+, 31%.

The number of pensioners surveyed were 60 (5%); Nurse Maude clients 110 (9%). Of the community sample 130 (76%) were female. Residential home residents totaled 449 (35%); rest home residents 243 (19%); private hospital patients 411 (32%). The number of females living in residential homes was 298 (66%), in rest homes 203 (83.5%), and in private hospitals 333 (81%).

Those living in the community were generally younger than those living in institutions (χ^2 = 103.53, df= 6, p <.001). Of those living in the community 41%

FIGURE CAPTION

Figure 1. Percent of total sample falling into each age group.

Fig. 1: Age Groups of Subjects.

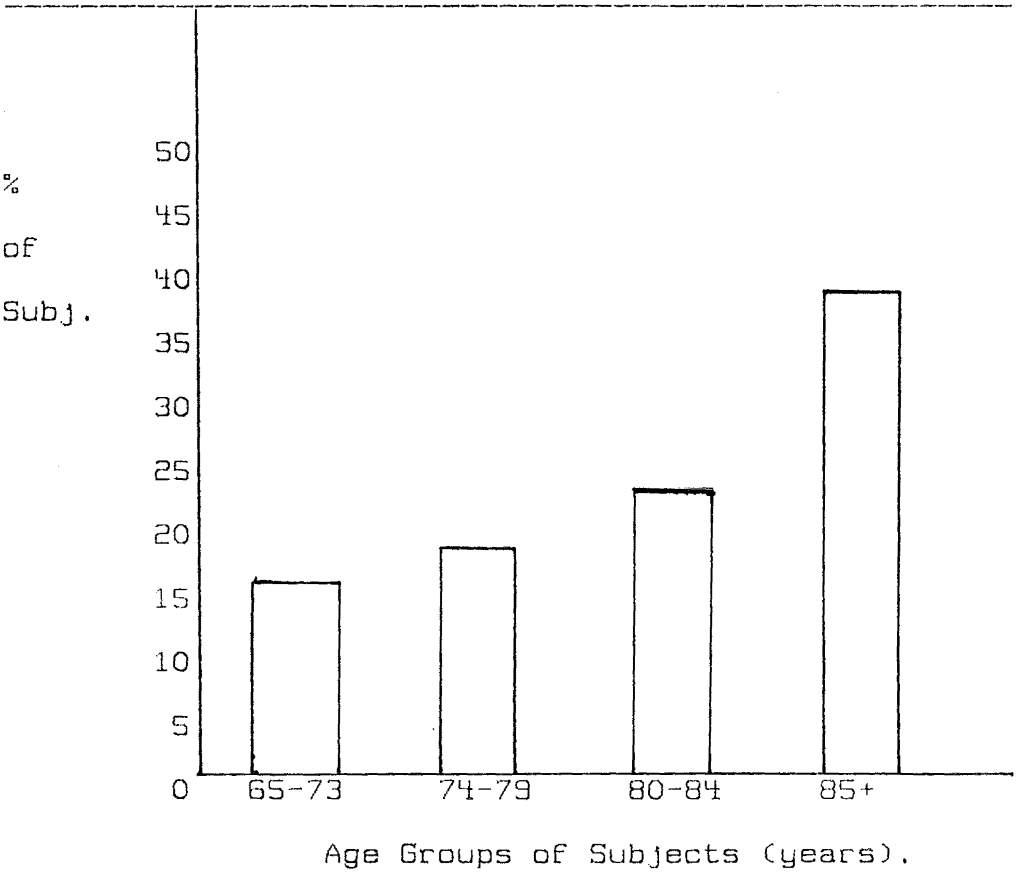
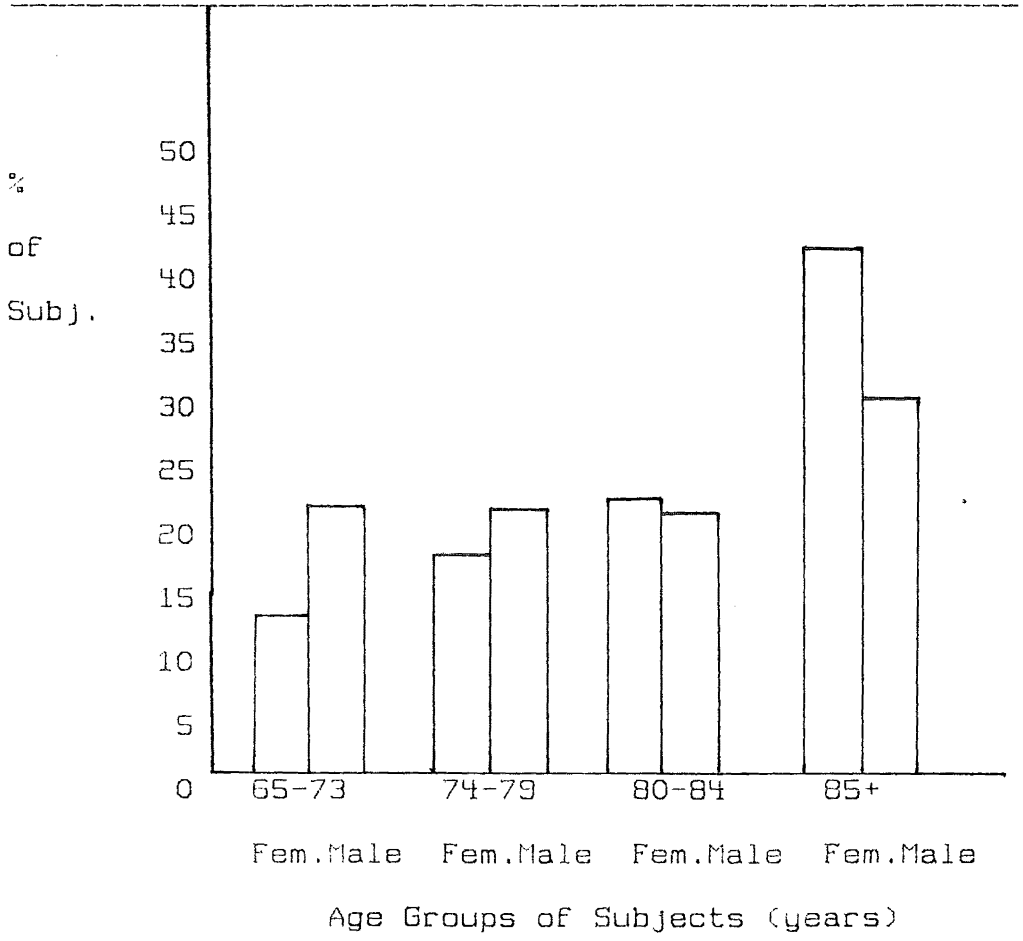


FIGURE CAPTION

Figure 2. Percent of total sample falling into each age group. The sexes presented separately showing different distributions.

Fig. 2: Age Groups of Subjects, Female and Male.



were 65-73 years, 24% were 74-79 years, 19% were 80-84 years, and 16% were 85+ years. The rest home sample were evenly distributed with 23% aged 65-73, 24% aged 74-79, 24% aged 80-84 and 29% aged 85+. Overall, in the institutionalised sample 12% were aged 65-73, 19% were aged 74-79, 25% were aged 80-84, and 44% were aged 85+. The mean age for the sample was 81.8 years.

Of the institutionalised 43% had been in that institution for less than a year, 36% had been resident for more than 1 and less than 5 years, 17% for 5 years and less than 10, 4% had been resident for more than 10 years.

The institutions ranged in size from 10 to 106, the smaller being mostly rest homes, the larger being residential homes or private hospitals. As the size of the institution increased there was less likelihood of a subject receiving nil drugs (χ^2 = 16.478, df = 5, $p < .01$). If a subject lived in a large institution, i.e., 60-100 residents, they were more likely to receive 7 or more drugs (χ^2 = 22.778, df = 5, $p < .001$). The cost of care ranged from $80 to $225 per week. The most expensive residential home was $163, the most expensive rest home was $138, the most expensive private hospital was $223 per week.

Most of the elderly surveyed (71%) lived in mixed accomodation. However 20% of females lived in single sex accomodation as did 9% of the males.

Most of the institutionalised sample, 70% could choose to have their own General Practioner or the house doctor, 18% had their General Practioner, while 12% had no choice and had to have the house doctor. While only 6.1% of females had no choice, 25.5% of males had no choice of doctor. Residential homes showed least choice, followed by rest homes then private hospitals ($\chi^2 = 25.208$, df =2, p <.001).

2. DRUG PREVALENCE

As shown in Figure 3, 8% of the elderly in the survey were on nil drugs. However the percentage of the community sample (both pensioners and Nurse Maude clients) who were not taking any drugs (prescribed or OTC) was 11. The percentage for the residential sample was 9. For rest homes 9.5% were on nil drugs. Finally for private hospitals there were only 3% on nil drugs. The mean number of drugs consumed was 3.4.

While the majority of the sample who were taking drugs were taking only prescribed drugs, 1% were only taking OTC drugs, and 3% were taking both prescribed and OTC drugs.

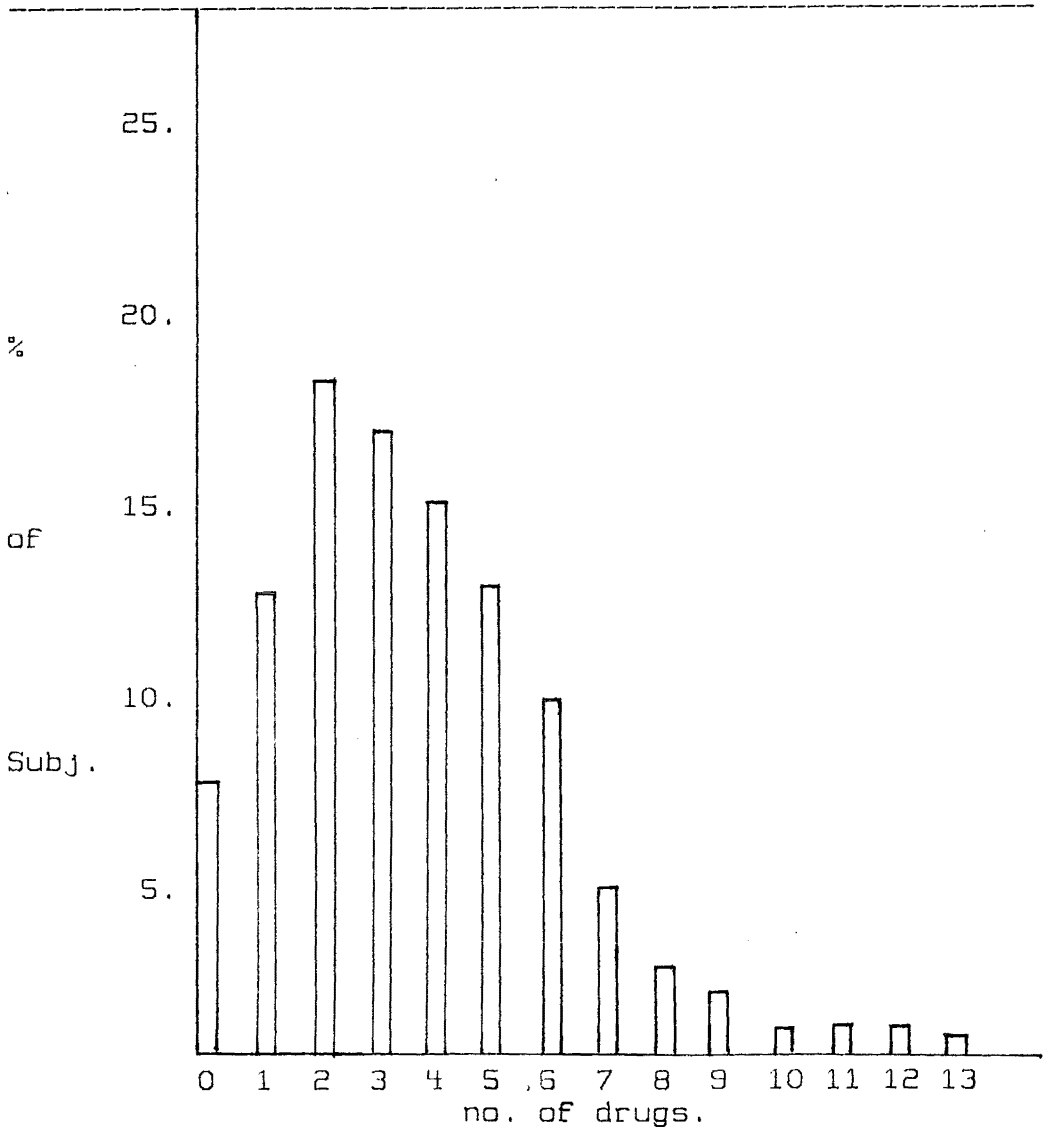
For those taking drugs, 52% were taking between 1 and 3 drugs, 39% between 4 and 6, and 9% were taking 7 or more.

A summary of the percentage on nil drugs in each category of residence, as well as the percentage

FIGURE CAPTION

Figure 3. Percent of total sample consuming nil drugs, 1 drug through to 13 drugs.

Fig 3: NUMBER of DRUGS : Percentage of total sample taking 0-13 drugs.



on 1-3, 4-6, and 7 or more drugs is given in Table 3. There were no significant differences over residential category. There were no significant differences with increasing age and number of drugs taken. When sex differences were investigated 6.6% of females were not taking drugs compared to 10.3% of males. There were more males than females taking 1-3 drugs, but more females taking 4-6 drugs and 7 or more drugs. There were more drugs taken by females than by males ($\chi^2 = 535$, df=1, $p < .0001$).

3. DRUG CATEGORIES

Of the 4,284 prescriptions, psychotropic drugs and drugs affecting cardiac function were prescribed with similar frequency. Psychotropic drugs accounted for 25.7% of all prescriptions and are summarised in Table 4. Of the psychotropic drug group, neuroleptics (phenothiazines, butyrophenones, dibenzoxazepines diphenylbutlpiperidines, reserpine and thioxanthenes) were the most commonly prescribed and accounted for 9.3% of all prescriptions. Next were anxiolytics, benzodiazepines, and diphenylmethanes; they accounted for 9% of the prescriptions. Antidepressants (tricyclics, MAOIs and tetracyclics) accounted for 4.7% of all prescriptions. As well as these major classes there were hypno-sedative drugs, other than the benzodiazepines, accounting for 2.7% of prescriptions.

Other drugs acting on the CNS were barbiturates which comprised 0.4% of all prescriptions, non-barbiturate anticonvulsants 0.9%, and antiparkinson agents 2.1% of all prescriptions. When these are added to the psychotropic drug class, 29.1% of the prescriptions are accounted for.

The most prescribed neuroleptic was thioridazine (Melleril), with 9.6% of all the subjects receiving it. Prochlorperazine (Stemetil) was received by 5.8%,

TABLE 4 : The Prevalence of Different Drug Classes over the total sample.

DRUG CLASS (%)of total prescriptions	MOST PRESCRIBED no.(%) of subjects N=1273
PSYCHOACTIVE (29.1%)	
Psychotropics (25.7%)	
Neuroleptics (9.3%)	thioridazine 123 (9.6%)
Anxiolytics (9%)	nitrazepam 171 (13%)
Antidepressants (4.7%)	doxepin 86 (6.7%)
Other hypno-sedatives (2.7%)	promethazine 52 (4.1%)
	chloral hydrate 52 (4.1%)
Anticonvulsants 54 (1.3%)	
-barbiturates (0.4%)	phenobarbitone 12 (0.9%)
-non-barbiturate (0.9%)	phenytoin sodium 19 (1.5%)
Anticholinergics (2.1%)	
antiparkinson (2.1%)	levodopa & carbidopa 89 (7%)
CARDIAC DRUGS (26.8%)	
Cardiovascular (8.9%)	digoxin 260 (20.4%)
Antihypertensive (3.7%)	methyldopa 34 (2.7%)
Diuretic (13.7%)	frusemide 269 (21%)

TABLE 4 cont.

DRUG CLASS (%) of total prescriptions	MOST PRESCRIBED no. (%) of subjects N=1273
ANALGESICS (12.8%)	
Anti-pyretic (7.2%)	dextropropoxyphene 101 (7.9%) (Digesic)
Anti-inflammatory (5.2%)	naproxen 58 (4.5%)
Centrally acting (0.4%) muscle relaxants & narcotics	orphenadrine 12 (0.9%)
LAXATIVES (7%)	
Bulk forming (1.4%)	granacol 32 (2.5%)
Traditional (5.6%)	senna 104 (8.2%)
DIETARY ADDITIVES (5%)	
Folic acid, Calcium, Iron (2.9%)	
Vitamins (2.5%)	
Potassium (4%)	
Bronchodilators (2%)	theophylline 37 (2.9%)
Antibiotics (1.9%)	nitrofurantoin 18 (1.4%)
Quinine sulphate (1.8%)	quinine sulphate 76 (6%)
Antacids (1.7%)	aluminium hydroxide 29 (2.3%)

TABLE 4 cont.

DRUG CLASS (%) of total prescriptions	MOST PRESCRIBED no. (%) of subjects N=1273
Hypoglycaemics (1.5%)	glibenclamide 27 (2.1%)
Antispasmodic (1.5%)	propantheline 36 (2.8%)
Thyroxine (0.9%)	thyroxine 39 (3.1%)
Antihistamines (0.6%)	trimeprazine 8 (0.6%)
Antiemetics (0.5%)	metoclopromide 19 (1.5%)
Antidiarrhoels (0.5%)	codiene phosphate 13 (1%)
Allopurinol (0.4%)	allopurinol 15 (1.2%)
Climetidine (0.3%)	climetidine 13 (1%)
Corticosteroids (0.2%)	prednisone 36 (2.8%)
Cancer drugs (0.2%)	stilboestrol 5 (0.4%)

and chlorpromazine (Largactil) by 5% of the sample.

The most prescribed anxiolytic agent was the benzodiazepine hypno-sedative nitrazepam (Mogadon); 13% of the sample received it. The next most prescribed was the hypno-sedative triazolam (Halcion); with 7% of all persons taking it. Diazepam (Valium) with 5%, lorazepam (Ativan) with 1%, and oxazepam (Serapax) with 1%, being the most prescribed antianxiety agents.

Of the antidepressants doxepin (Sinequan) was prescribed to 6.7% and amitriptyline (Tryptanol) to 3.9%. Promethazine hydrochloride (Phenergan) an antihistamine, was used to promote sleep for 4.1%. The other hypno-sedatives were chloral hydrate (Chloradorm) used by 4.1% and chlomethiazole (Hemineurin) by 0.9% of the sample.

The most common anticonvulsant was phenytoin sodium (Dilantin) at 1.5%, with the most common antiparkinson agent being levodopa and carbidopa (Sinemet); 7% of the sample received it.

The next most commonly prescribed drug class was that having effect on cardiac function. Prescriptions within this class accounted for 26.8% of all prescriptions. Cardiovascular drugs accounted for 8.9% of all prescriptions, antihypertensive agents 3.7%, and diuretics 13.7%.

A cardiac glycoside, digoxin was the most

prescribed within this class 20.4% of all subjects received it. The most prescribed antihypertensive agent was methyldopa (Aldomet) with 2.7% of the sample consuming it. The most prescribed diuretic was a loop diuretic, frusemide (Lasix) with 21% receiving it, followed by the thiazide diuretic cyclopenthiazide with 9.7% receiving it.

The third most commonly prescribed drug class was analgesics which accounted for 12.8% of the total prescriptions. Antipyretic drugs accounted for 7.2% of prescriptions, anti-inflammatory agents 5.2%, and centrally acting muscle relaxants and narcotic agents numbered only 0.4%.

The most prescribed individual drug was dextropropoxyphene napsylate with paracetamol (Digesic). About 8% of the sample used this drug. Next was aspirin at 7.7%, then paracetamol at 5%. These drugs all have anti-pyretic function. The most common anti-inflammatory drug was naproxen (Naprosyn), 4.5% of the sample used this drug.

The fourth most commonly prescribed drug class was the laxatives, with 7% of the total number of prescriptions being for this type of medication. Bulk forming preparations accounted for 1.4% prescriptions, and 5.6% were for more traditional laxatives with harsher action.

The fifth most commonly prescribed drug class

was that of dietary additives which involved 5% of the total prescriptions. There were 2.9% of all prescriptions for folic acid, calcium or iron (oral or parenteral). There were 2.5% of all prescriptions for vitamins, and potassium supplements were prescribed (to redress the potassium loss from diuretic intake) to 4%.

The remaining drug classes represented 2% or less than 2% of the drugs prescribed and in reducing order of importance were: bronchodilators 2%, antibiotics 1.9%, quinine sulphate (taken for cramp) 1.8%, antacids 1.7%, hypoglycaemic agents 1.5%, antispasmodic agents (anticholinergic action) 1.5%, thyroxine 0.9%, antihistamines 0.6%, antiemetics 0.5%, antidiarrhoels 0.5%, allopurinol (for gout) 0.4%, climetidine (duodenal ulcers) 0.3%, and corticosteroids and cancer drugs, 0.2% each. A summary of drug classes prescribed can be found in Table 4.

4. COMMUNITY COMPLIANCE

For the community sample of pensioner unit residents (60) and Nurse Maude clients (110), outdated medications were only present for 4% of individuals. There were 14 different drugs involved: 2 anti-emetics, 2 antihypertension agents, 2 anxiolytic agents, 3 anti-inflammatory agents, 2 diuretic agents, an antihistamine, a hypno-sedative, and a multi-vitamin preparation.

Labelling was adequate in the majority of cases although the instruction " take as required" occurred in 2 cases, both for analgesics. The instruction "take as directed" with no further explanation was present 7 times. The drugs involved were suppositories - 2 cases, an anxiolytic agent, a neuroleptic agent - 2 cases, a diuretic, and a laxative. One subject had 4 of these prescriptions. Small print was a problem for 8 subjects. Safety lids and no instructions at all were a problem for 2 subjects each. Blister packs were a problem for 3 subjects. In summary, labelling was generally adequate but for 17.6% of subjects labelling was inadequate.

Most of the sample visited or had the doctor visit quite regularly: 37% had seen the doctor within a month, 25% within 3 months, 16% within 2 weeks of the interview, 13% within 1 week, 7% had been to see

the doctor within a year and 2% had not seen the doctor within 6 months.

The majority believed they were taking their medication as directed. Subjects not taking their medication as directed totalled 11%. The most common reason for non-compliance was they thought they did not need the drug (47%), that the drug was too strong and had unpleasant side effects (26%), and that they forgot (26%).

Most subjects showed a complete understanding of why they were taking their medication. For the pensioner unit residents this held true for most with a prescription of up to 5 drugs. Of the three subjects confused one was sure of 4 drugs and confused with 1. Another subject was taking 4 drugs and was confused with 1. The other subject was taking 3 drugs and was confused with 1. For the Nurse Maude clients if they were confused about their medication generally a spouse, daughter or neighbour administered the medications. There were 13 in this category. One subject was on 11 drugs. Of those administering their own and confused, 5 confused 1 drug, one subject taking drugs for Parkinson's disease thought laxatives, diuretics, and vitamin c tablets were all for Parkinson's disease. In summary, of those in the community 13% had little or no understanding of their drugs.

There was a very low incidence of use of OTC

drugs admitted: 11% used them, the doctor knew of the drugs taken in 2% of the cases.

5. ADVERSE REACTIONS

The noting of adverse reactions on patient records was examined. For the total sample only 2% of such records were found.

Of adverse reactions reported 57% were in the community. The remaining 11 cases were found in the rest home category of residence.

The mean age of the rest home group was 81 years. There were 10 females and 1 male. Two homes reported 3 each, the other cases were scattered. The mean number of drugs per subject was 4.1. The range was 2-7. The drugs involved were varied, and the other drugs prescribed concurrently were also varied (see Table 6).

Two pensioner unit residents and 14 Nurse Maude subjects were implicated in the community. The mean age was 77.6 years. There were 11 females and 5 males. The mean number of drugs consumed was 4.2, with a range from 1 to 11. The range of drugs involved is summarised in Table 5 and Table 6.

TABLE 5 : Adverse Reactions to drugs

Drug involved in Adverse Reaction	Strength *	Frequency times per day	no. of tablets
REST HOME RESIDENTS.			
Digoxin (3 cases)	0.25 to 0.0625	daily	2
Cyclopenthiazide (Navidrex)	0.5mg	daily	5
Nitrazepam (Mogadon)	5mg	nightly	1
Thioridazine (Melleril)	25mg	twice	2
"	50mg	twice	2
Doxepin (Sinequan)	25mg	three	3 from 5.
Benztropine (Cogentin)	2mg	twice	2
Procycidine (Kemadrin)	5mg	twice	2
"	5mg	daily	1
COMMUNITY			
Glyceryl (Anginine) (2 cases)	0.6mg	p.r.n.	-
Propranolol (Inderal)	160mg	three	3

TABLE 5: cont.

Drugs involved in Adverse Reactions	Strength *	Frequency times per day	No.
Pindolol (Visken)	5mg	daily	1
Triamterene (Dyazide)	-	three to daily	3 1
Frusemide (Lasix)	40mg	daily	1
Naproxen (Naprosyn)	250mg	twice	2
Sulindac (Clineral)	100mg	twice	4
Diazepam (Valium)	5mg	three	3
Chlorpromazine (Largactil)	25mg	three	3
Levodopa (Eldopar) (2 cases)	1 mg	twice	2
Alginic acid (Gaviscon)	-	four	-
Phenytoin sodium & phenobarbitone (Garoin)	-	three	3
Oxazepam (Serepax)	10mg	twice	2

* All these drugs were prescribed within the normal reccommended range.

TABLE 6: Drugs prescribed concurrently with those involved in Adverse Reactions.

Drug Involved in Adverse Reaction	Drugs prescribed concurrently.
REST HOME	
Digoxin	Cyclopenthiazide, ferrous sulphate, ascorbic acid.
Digoxin	Frusemide, spironolactone, terbutaline, thioridazine, phenytoin sodium, senna.
Digoxin	Glyceryl trinitrate, potassium chloride, ibuprofen, paracetamol triazolam, frusemide.
Cyclopenthiazide +K	Potassium supplement, digoxin nitrazepam, aluminium hydoxide.
Nitrazepam	digoxin, frusemide, potassium chloride.
Thioridazine	Promethazine.
Thioridazine	Nitrazepam, procyclidine, levodopa & Carbidopa, ferrous sulphate & folic acid.
Doxepin	Digoxin, frusemide, prednisone.
Benztropine	Thioridazine.
Procyclidine	Thioridazine.
Procyclidine	Chlorpromazine, hydrochlorothiazide amiloride hydrochloride.
COMMUNITY	
Glyceryl trinitrate	Digoxin, frusemide, oxazepam, nitrazepam.
Glyceryl trinitrate	Cyclopenthiazide +K, Digesic*,

TABLE 6: cont.

Drugs involved in Adverse Reactions	Drugs concurrently prescribed.
Propranolol	
Pindolol	
Triamterene	Propranolol
Frusemide	Insulin, senna
Sulindac	Digesic, Chlorpromazine, ibuprofen pentazocine, carbamazepine, hydroxocobalamin
Naproxen	Timolol maleate, bendrofluazide, Digesic, nitrazepam, dioctyl sodium.
Oxazepam	Glyceryl trinitrate, digoxin, frusemide, potassium chloride, doxepin, dicyclomine hydrochloride, granacol granules, senna, ascorbic acid, crotamiton.
Phenytoin sodium & phenobarb	Frusemide, potassium chloride, levodopa & carbidopa.
Levodopa	Frusemide, mianserin, dioctyl sodium.
Levodopa	Cyclopenthiazide +K, Digesic.
Alginic acid	Bendrofluazide, senna.
Diazepam	Methyldopa, frusemide, potassium chloride, senna, penicillin Multi Vitamin-6.
Clorpromazine	Cyclopenthiazide +K, Co-dergocrine mesylate, triazolam, granacol granules.

* Dextropropxyphebe napsylate + paracetamol for reasons of space represented as Digesic.

6. PLACEBO USE

Placebos were used by a few institutions to reduce the total number of drugs consumed by a subject, without causing the subject concern.

Generally the use of placebos was a concept not used, with only 9 cases (0.7%) of the total sample being involved. The 9 cases were all females, living in one particular residential home, and two rest homes.

In the first rest home, two residents had nitrazepam, prescribed for sleep, changed to aspirin. One resident was 86 years old, had lived there for 3 years and was attended by the house doctor. She was taking a total of 8 drugs: digoxin, frusemide, potassium chloride, propranolol, naproxen, aspirin (for nitrazepam) and allopurinol. The other resident was 77 years old, had lived there for 5 years, was also attended by the house doctor who prescribed her nitrazepam (changed to aspirin) and Aquacare skin cream. The other rest home catered for 13 females, the resident concerned was 80 years old and had lived there a year. She was given a candy coated chocolate sweet for night sedation. She received 8 drugs: digoxin, frusemide, potassium chloride, captopril, dextropropoxyphene hydrochloride & paracetamol, diazepam, thioridazine and granacol granules.

The residential home catered for 59 residents

and was a mixed sex establishment. The residents had a choice of doctors. Six residents were taking vitamin C for sleep, and no night sedation had been prescribed. There were 15 others at that home taking night sedation (nitrazepam), some at half strength. One resident aged 87 had lived there for 2 years and was taking vitamin C and Multivite 6. An 82 year-old resident of 4 years, who also had drug-free days, was taking vitamin C, sodium fluoride, bendrofluazide, and ibuprofen. There was an 88 year old who had been resident there for 3 years and was taking digoxin, hydrochlorothiazide amiloride hydrochloride, aspirin and vitamin C. Another 88 year old had been resident for 13 years, was taking digoxin, frusemide, potassium chloride, cephalexin monohydrate and vitamin C. An 86 year old of 4 years residency was taking 4 drugs: frusemide, chlorpromazine, co-trimoxazole and vitamin C. Finally a 79 year old, resident 2 years was taking only vitamin C.

For this small group the mean age was 83.6 years and the mean number of drugs consumed was 4.2, both slightly higher than the overall means.

7. DRUG-FREE DAYS

Drug-free days was another indicator of rational drug therapy. The concept was used to reduce the incidence of severe side effects caused through drug accumulation and the resultant toxicity.

The percentage of subjects having drug-free days was 5%. Females were involved in 90% of the cases. The age group most represented was 85+ years (44%). Private hospitals were involved in 44% of the cases, residential homes in 35%, and rest homes and the community responsible for 10% each. The majority (57%) were taking between 4-6 drugs. The main drug classes were cardiac drugs (41%: digoxin 12, diuretic agents 16). Laxatives were involved in 22% of cases. Psychotropics were involved in 12% of cases, (anxiolytics 3, neuroleptic 3, antidepressants 2). Analgesics were involved in 10% of cases.

As the size of the residence increased there were fewer drug-free days for residents.

8. REPEAT PRESCRIPTIONS

The frequency of repeat prescribing was measured as an indicator of rational drug therapy. In the total sample all prescriptions were repeated for 86% of subjects. Prescriptions were issued with no repeat for 7%. For 7% some prescriptions were issued as repeats, some not. In the community all medications were repeated for 58% of the recipients. In the institutions medications were all repeated for 98%. This difference in use of repeat prescribing was statistically significant (χ^2=284.84, df=1,p <.0001).

When patterns of repeat prescribing were examined with respect to residence, those living in rest homes were less likely to have prescriptions repeated. The percentage of rest home residents not having repeat prescriptions was 10%. There was also a difference between doctors and repeats. If a subject had the house doctor rather than their own doctor, or a choice of either house or their own they were less likely to receive repeats (χ^2=29.62, df=1,p <.001). On further analysis of the rest home results, two rest homes practiced no repeat prescribing for their residents.

As residents aged, they were more likely to receive all medications repeated (χ^2 = 59.70, df=1, p <.001).

9. PRN PRESCRIBING

Pro re nata (PRN) or as required prescribing, was another indicator of rational use of drug therapy. High usage of PRN prescribing diffused responsibility from the doctor to the nursing staff in skilled care facilities and to the owner in rest homes and residential homes. In the community PRN prescriptions can lead to over consumption without supervision.

The results show the PRN instruction was used more for those in the community than for those in institutions ($\chi^2 = 16.68$, df=1, $p < .001$). In the community 82 or 16% of all prescriptions were written PRN.

However private hospitals also had a high level of PRN usage in comparison to other levels of institutional care. Of all prescriptions in private hospitals 231 (14.5%), were prescribed PRN, with only 149 (7%) of prescriptions in the other levels of institutional care written that way ($\chi^2 = 54.66$, df=1, $p < .001$).

When PRN prescription of psychotropic drugs was compared across residence only 6.1% of drugs prescribed that way were prescribed to community subjects, 14.1% to residential home subjects, 16.7% to rest home subjects, and 19% to private hospital subjects. The prescription of laxatives, PRN was

consistent across residence category with 14% for both community and residential homes, and 15% for private hospitals although in rest homes PRN was the prescription pattern for 25%.

The PRN instruction was appropriate for many prescriptions, for example for glyceryl trinitrate (49 cases), and for such classes of drug as asthma drugs (9), analgesics (172) and quinine sulphate (9). For antacids (36), laxatives (71) and psychotropic medication (71), other instructions were more appropriate.

10. NIGHT SEDATION

The prevalence of night sedation was compared across residential levels. Over the total sample there were 636 prescriptions (15% of all prescriptions) for night sedation (Table 7). The most common drug group was anxiolytic, with 46% of all night sedation being in this class. Nitrazepam was prescribed most often (55% of anxiolytics prescribed). Triazolam accounted for 28% of anxiolytics.

The antidepressant drug group was next most commonly used accounting for 39% of all night sedation. The most prescribed drug was doxepin (29% of the antidepressants used).

The neuroleptic drug group was used as night sedation for 15% of all night sedation prescriptions. The most commonly prescribed was thioridazine (48% of neuroleptic prescriptions).

Of all the drugs prescribed to the community sample, 9.5% were for night sedation. In the community 28% of subjects were prescribed night sedation. The most common drug group was anxiolytic (67% of night sedation drugs). Nitrazepam was given to 53% and triazolam to 31%. Antidepressants were given as night sedation to 25% the most commonly prescribed was doxepin (10%). Neuroleptics were given to 8%.

Of all the drugs prescribed to residential home

TABLE 7 : Night Sedation.(N=636)

Drug Group N(%)		
Anxiolytic 290 (46%)	Neuroleptic 95 (15%)	Antidepressant 251 (39%)
Nitrazepam 160	Thioridazine 46	Doxepin 72
Triazolam 82	Chlorpromazine 24	Chloral hydrate 47
Diazepam 22	Haloperidol 14	Amitriptyline 27
Oxazepam 13	Trifluoperazine 3	Promethazine 27
Lorazepam 9	Methotrimeprazine 3	Trimipramine 16
Chlordiazepoxide 3		Imipramine 16
*		Mianserin 12

*= missing cases, other drugs were prescribed once only.

residents drugs for night sedation accounted for 14.5%. In this group 46% were on night sedation. The most prescribed drug group was anxiolytic (49.5%), with nitrazepam accounting for 54% of the anxiolytics and triazolam 26% of anxiolytics prescribed. Antidepressants were prescribed to 41%, doxepin accounting for 32% of antidepressants prescribed. Neuroleptics were prescribed as night sedation to 9.6% of the residents.

In the rest home sample 17% of all drugs prescribed were for night sedation. There were 49.8% taking night sedation. Anxiolytic agents and antidepressants were the drug groups accounting for most of the prescriptions (41% each). Nitrazepam accounted for 61% of anxiolytics and triazolam accounted for 31% of anxiolytics prescribed. The most commonly prescribed antidepressant was doxepin which accounted for 37% of antidepressants prescribed. Neuroleptics accounted for 18% of prescriptions for night sedation, with 10% being on thioridazine and 7% on chlorpromazine.

In the private hospital group, 16% of all prescriptions were for night sedation. Of this group 63.5% were taking night sedation. The most prescribed drug groups were anxiolytics and antidepressants which accounted for 81% of medication for night sedation (40.5% each). The most commonly prescribed drugs were nitrazepam (53% of anxiolytics) and triazolam

(29% of anxiolytics). For the antidepressants, chloral hydrate was most used (29% of antidepressants used), and doxepin, amitriptyline and promethazine were used with equal frequency (15%). Neuroleptics accounted for 19% of those taking night sedation, the most prescribed being thioridazine (55% of neuroleptics) and 3% were on haloperidol. The use of nitrazepam and triazolam was with similar frequency across residences, the use of doxepin increased as level of care increased, and it was notable that the use of neuroleptic drugs increased as level of care increased. In addition chloral hydrate and promethazine as well as doxepin were drugs of choice in private hospitals. A summary of these results are presented in Table 8.

The difference in frequency of use of night sedation was significant (χ^2 = 13.6, df=1, p <.01), i.e., there was more use of night sedation in the institutionalised than in those living in the community. There was a significant difference in the frequency of use of night sedation across institutional level, with private hospitals using more than rest or residential homes (χ^2 = 26.948, df=2, p <.001).

When the strength of nitrazepam prescribed was examined it was found that some subjects received half standard strength medication, some standard dosage, and some twice the recommended geriatric dose (or the maximum standard dose). There was considerable variation over residence as evident from Table 9.

TABLE 8 : Night Sedation differences over Residence.

RESIDENCE N (%) on night med.	DRUG GROUP Anxio-lytic N (%)	Neuro-leptic N (%)	Anti-depressant N (%)
Community 48 (28)	32(67)	4(8)	12(25)
Residential 208 (46)	104(49.5)	20(9.5)	85(41)
Rest home 120 (49.8)	49(41)	22(18)	49(41)
Private hospitals 259 (63.5)	105(40.5)	49(19)	105(40.5)
Totals	290	95	251

TABLE 9 : Nitrazepam Prescription Over Residence. N(%)

RESIDENCE(N)	STRENGTH OF NITRAZEPAM in Mg. 2.5	5	7.5	10	no str
Community(19)	0	12(63)	0	7(37)	0
Residential(62)	6(10)	30(48)	1(2)	20(32)	5(8)
Rest home(32)	1(3)	21(66)	1(3)	8(25)	1(3)
Private Hosp(58)	3(5)	26(45)	0	28(48)	1(2)
Total 171	10(6)	89(52)	2(1)	63(37)	7(4)

11. DRUG PRESCRIBING DIFFERENCES OVER RESIDENCE

a. Digoxin.

Digoxin was prescribed for cardiovascular symptoms to 20% of the subjects, however the frequency of use was relatively consistent, with 15% of subjects living in the community being prescribed digoxin, 20% of residential home subjects, rest homes subjects 17%, and private hospitals subjects 23%. Usage was similar between females (21%) and males (17%). With age there was an increase, i.e., as a person aged it was more likely for them to be prescribed digoxin. Only 7% of those aged 65-73 years were taking digoxin, 19% in the group 74-79, 19% in the group 80-84, and 27% in the 85+ age group were prescribed digoxin.

b. Laxatives.

The use of laxatives showed a significant difference over level of residence: 5.8% of the community sample used them regularly, 9% of residential home residents, 10% of rest home residents, and 19% of private hospital residents ($\chi^2 = 30.729$, df=3, $p < .001$). There were great individual differences between homes, and within levels of care.

c. Antiparkinson Drugs.

About 7% of the subjects were afflicted with

Parkinson's disease in the total sample. Proportionally more males (8.7%) than females (6%) had the disease. More prescriptions were consumed in institutions than in the community. Of those living in the community 5% took this type of medication, 6% of those in residential homes, 7% in rest homes and 8.6% in private hospitals. Those with Parkinson's disease were more likely to be younger than the general sample, 18% of those aged 65-79 had Parkinson's disease, while only 7% of those aged more than 80 had it.

d.Benzodiazepines.

This common drug group was prescribed for 30% of the subjects. There were no sex differences in prescription patterns, and although there was a tendency towards more prescription with age, this did not reach statistical significance.

There were proportionally more subjects being prescribed benzodiazepines in institutions than in the community but this difference did not reach statistical significance.

The most prescribed drugs within this group were the sedatives nitrazepam (44%) and triazolam (23%). Anxiolytics commonly prescribed were diazepam (17.6%), oxazepam (7%) and lorazepam (7%).

e.Phenothiazines

Phenothiazines form the major division of the

neuroleptic drug group or drugs with an antipsychotic action. There were 23% of the sample taking phenothiazines. While 25% of all females received them only 17% of males received them (χ^2=9.10, df=1,p <.01), i.e., there was a statistically significant difference between prescription rates of phenothiazines for females and males.

For those living in the community 8.8% were prescribed phenothiazines, 19% in residential homes, 26.5% in rest homes and 33.8% in private hospitals. The difference in prescription patterns was statistically significant (χ^2=49.20, df=3, p <.001).

When age differences were investigated it was found that there were essentially equivalent frequencies of drug prescription across age groups.

The most commonly prescribed neuroleptic was thioridazine (41%) followed by prochlorperazine (25%), and chlopromazine (22%).

f.Tricyclics.

The tricyclics are the major division of the group antidepressant. When sex differences were examined it was found that 17% of females were prescribed tricyclics, while only 6.7% of males received them (χ^2=19.86, df=1,p <.001), showing a statistically significant difference for rates of prescription between females and males.

There were 15% of the age group 65-73 taking tricyclics, 15% of the age group 74-79 and 14% in the age group 80-84. The very old, aged 85+ were under-represented at 9% this difference was statistically significant (χ^2=9.000, df=1,p <.001).

The analysis for residence showed 6.6% of those living in the community were prescribed tricyclics, 15.6% of residential home residents, 17% of rest home residents and 15% of private hospital residents. The difference between the level of prescribing for those in the community and those in the institutions was statistically significant (χ^2=10.38, df=1, p <.001).

Doxepin was the most prescribed (46%), followed by amitriptyline (27%) and imipramine (12%).

12. WITHIN RESIDENTIAL LEVEL PRESCRIBING DIFFERENCE

There was considerable variation in prescribing rates between individual homes within each residential level. Prescription rates varied over all drug groups prescribed and more particularly over specific drugs prescribed. Many homes showed high use of all classes and high levels of psychotropic drug prescription, with many subjects receiving multiple drugs within the same class of psychotropics. In the residential home level, 16.7% of subjects receiving psychotropic drugs were receiving more than one drug or more than one

TABLE 10 : Prescription of more than one Psychotropic over residence N(% in residential level)

Classes of Drug	Residence		
	Res.	Rest	Prv H.
2 of 1 class	10(13)	7(15)	11(11)
class + class*	45(60)	31(69)	69(67)
class +class + class	12(16)	3(7)	7(7)
2 of 1 class** + class	5(6)	3(7)	11(11)
2 of 1 class + class +class	1(1)	1(2)	2(2)
2 of 1 class +2 class	3(4)	0	0
4 classes	0	0	1(1)
2 of 1 class +2 of 1 class +class +class	0	0	1(1)
Total	75(100)	45(100)	102(100)

* e.g. Triazolam + Amitriptyline
** e.g. Clorpromazine + Thioridazine+ Promethazine.

drug class; 18.7% in the rest home residential group and 25% in the private hospital group. Full details are presented in Table 10. The drug classes were anxiolytics (including benzodiazepine hypnotics), neuroleptics, antidepressants, antihistamines used for sedation (promethazine), and other hypnotic agents (chloral hydrate, chlormethiazole).

In one residential home 35%, were on combinations of psychotropic drugs. Across all drug classes only 2% were receiving nil drugs, 35% received 1-3 drugs and 63% received 4-6 drugs. For age, 10% were 65-73, 15% were 74-79, 30% were 80-84, and 45% were 85+. This home catered for 37 females and 3 males. In another residential home 10% were on combinations of psychotropic drugs, 14% were on nil drugs, 52% were on 1-3 drugs, 32% were on 4-6, and 2% were on 7+ drugs. Fourteen percent were 65-73, 22% were in the group 74-79, 16% were 80-84 and 48% were 85+. This home catered for males only.

The extremes for rest home care were further apart, for one there were no residents on combinations of psychotropic drugs, 25% on nil drugs, 67% on 1-3 drugs, and 8% on 4-7 drugs. In this home 37% were in the 65-73 age group, 17% in both the 74-79 and 80-84 age groups, and 29% in the 85+ age group. This home catered for 13 females and 11 males. In another home 36% were on combinations of psychotropic drugs, 0 on nil drugs, 36% on 1-3 drugs, 64% on 4-7 drugs.

Here 21% were in the age group 65-73, 21% in 74-79, 37% in the group 80-84, and 21% in the 85+ group. This home catered for 14 females.

The variation shown by private hospitals can been seen with the first hospital catering for 72 females and 4 males, 14% were on combinations of psychotropic medications. Five percent were on nil medication, 36% on 1-3 drugs, 58% on 4-7 drugs. Five percent were in the age group 65-73, 20% in the group 74-79, 17% in 80-84 group, 58% in the 85+ group. In a private hospital catering for 21 females and 5 males there were 42% on combinations of psychotropic medication. Over all drugs there were none on nil drugs, 19% on 1-3, 73% on 4-6, and 8% on 7 or more drugs. Twelve percent were in the age group 65-73, 19% in 74-79 age group, 15% in 80-84 age group, and 54% in 85+ age group.

CHAPTER V

DISCUSSION

As mentioned in the introduction the elderly living in institutions tend to be very old and predominantly female. In this study 16% of the community sample were 85+ years old whereas, of the institutionalised, 44% were in this age group. However 76% of the community sample were female as were 76% of the institutionalised.

Although in this study there was a significant difference in age distribution across residential level, there was not a difference in frequency of drugs prescribed. The expectation was that as a person aged and suffered more disease and disability then more drugs would be prescribed to control these diseases and disabilities. While the frequency of drug prescription was similar over residence levels, and also over age, there were differences in the prescription of different drug groups. These differences are discussed in a later section of this discussion.

There were significant differences between the sexes and numbers of drugs prescribed for each. Females were less likely to be taking nil drugs and more likely to be taking 7 or more drugs. May et al (1982) found

that females were prescribed more drugs than males. Hale et al's (1979) results were similar with males being prescribed fewer drugs than females. Both these studies reported increased consumption of drugs with increase in age.

1. INCIDENCE OF PHARMACOLOGY

The mean number of drugs prescribed in this study was 3.4 which is lower than the figure of 5.8 reported in an earlier study by Lawson et al (1976) for New Zealand hospital patients. In another hospital study Bergman et al (1981) reported an average number of drugs of 3.7. The community study by May et al (1982) reported the mean number of drugs prescribed as 3.2. Kalchthaler et al (1977) in their study based in a long-term care institution reported a mean prescription rate of 3.33. The present results tend to be comparable to the prescription rate of these studies.

In this study the most prescribed drug class was psychoactive which accounted for 29.1% of prescriptions, followed by cardiac drugs (26.8%), analgesics (12.8%), laxatives (7%), and dietary additives (5%). Bergman et al (1981) reported similar figures with cardiovascular first and psychotropic second most prescribed drug class. In a community-based study Guttman (1978)

reported cardiovascular (39.3%) to be most prescribed followed by sedatives and tranquillisers (13.66%), analgesics (55.4%), vitamins(8.1%), and laxatives (7.1%). It is difficult to make comparisons as each study measured different variables but there appear to be similarities with other studies.

Evident from the results of this study and from the literature generally is that the drug prescription rate is very high given the nature of the recipent population. The literature on changed pharmocokinetics and pharmacodynamics in the elderly stresses the resultant likelihood of drug interactions, adverse effects and the severe potential for drug toxicity. This should make cautious drug prescribing mandatory. The consensus in the literature is that no more than 3 medications should be prescribed concurrently without running the risk of adverse reactions or interactions. In this study, the mean prescription rate was 3.4 drugs per subject. Three drugs have also been stated as appropriate for community elderly to avoid compliance problems.

2. COMMUNITY COMPLIANCE AND OTC DRUG USAGE

In this study factors that hinder compliance to medication instruction were measured and it was found that generally there were few problems, a similar finding to Darnell, Murray, Martz and Weinberger

(1986). Factors such as small print, and inadequate instruction can lead to overdose and adverse reactions. The use of safety lids leads to non-use of a drug. Hoarding of old medications tends to encourage self diagnosis of a later complaint, and the resulting usage of less effective medication if shelf-life is important. The fact there were few problems in this area can probably be attributed to high standards of practice by pharmacists.

For several subjects non-compliance was deliberate and reflected concern for unneccessary medication (in their opinion) or medication that caused unpleasant side-effects. Compliance was a problem for those with memory deficits. For the confused and those who were non-compliant with instructions, medication was generally administered under supervision. This study is limited with respect to measures of compliance as it relied on verbal report, and although understanding of the purpose for medication was measured, there is no accurate measure of actual medication consumption.

There is also a probable under-reporting of OTC drug use. Other studies, such as that reported by Chein et al (1978) report 40% of all prescriptions as OTC. In this study, over the total sample 1% were only taking OTC drugs and 3% were taking both OTC and prescribed drugs. Many subjects confused the purpose

of the study and believed their doctors were involved. The presence of a nurse with the Nurse Maude sample may have led to under reporting. OTC drugs were used by 11% of the community yet only 2% informed their doctors of the fact they used them, suggesting further that there may be hesitation to admit use. Another logical reason for low responding is that the elderly may underestimate the potency of these agents and so discount them. The OTC drugs used were analgesics, laxatives, vitamin supplements and cough and cold medications. Masking of disease can be the result of indiscrimunate OTC use as reported by Michocki (1982) and severe interactions with other preparations as reported by Gerbino et al (1982). Gerbino (1982) suggested that alcohol is a potent OTC. This study did not address the prevalence of alcohol, nicotine, or caffiene use, but recognised the potential for interaction with other prescribed and non-prescribed medications.

The importance of OTC drugs was often discounted by the institutional staff either by denying their availability or by administering them, PRN, from supplies kept for such purposes.

3. DRUG INTERACTIONS AND ADVERSE REACTIONS

Although the literature reports high levels of adverse reactions to drugs in the elderly, especially when multiple drugs are used, this study reported only 2% of the sample suffered adverse reactions. However, as mentioned, some non-compliance in the community was as a result of adverse reactions. An explanation for the high level of reporting coming from the community (57% of all responses) was the supervisory role the Nurse Maude nurses provided. The community sample had a choice to take a medication or not; this choice was not available to the institutionalised. Some institutions used placebos and drug-free days as a means of reducing adverse reactions; this is discussed in subsequent sections. It is likely from the literature that many institutions increased the dose or added another drug to the regimen on the appearance of an adverse reaction (Shrimp, Ascione, Glaser and Atwood, 1985).

In this study more females than males suffered adverse reactions, a finding consistent with those of Caranasos et al (1974) and Hurwitz et al (1969). In this study those suffering adverse reactions were prescribed a mean of 4.1 drugs which was higher than the mean for the total sample, and higher than either a study by Williamson et al (1980) or that of Hurwitz et

al (1969) who reported means of 2.3 and 3.4 respectively. The drug groups involved in this study were consistent with those reported by Williamson et al (1980) and involved hypotensive agents, antiparkinsonian agents, diuretics and psychotropics. The drugs listed in Table 6 were prescribed concurrently with the drug concerned with the adverse reaction, not only do many share similar pharmacologic action but many have been implicated in adverse reactions themselves, and would result in an additive effect of adverse reactions. The example Shrimp et al (1985) gave of this is the nausea caused by one agent may not be clinically important but the nausea from four agents may be significant. A rational solution to the adverse reaction may have been to reduce those concurrently prescribed drugs as well.

In the introduction, Table 1 lists drugs best prescribed at reduced dosage to avoid unwanted side effects. Seven of the drugs implicated in Table 5 appear in Table 1 (nitrazepam, oxazepam, diazepam, digoxin, thioridazine, levodopa, propranolol) and all were prescribed at standard doses. Table 2 lists drugs that have potential for severe side effects in the elderly, 2 drugs listed there appear on list 5 (digoxin, chorpromazine).

4. ATTEMPTS TO REDUCE ADVERSE REACTIONS

Placebos have been used by a few institutions to reduce the number of drugs consumed and to reduce the likelihood of adverse reactions and interactions. Placebos have their effect by the patient being convinced the drug is potent. Many elderly are difficult to convince that reducing their medications is prudent. They regard a large array of medications as indicators of their importance. Relatives also view medications as evidence that their relative is receiving adequate care from the doctor.

It is of concern however when a drug is replaced with another drug and called a placebo. In this study both aspirin and Vitamin C were used this way. Aspirin has been responsible for many adverse reactions leading to hospitalisation (Caranasos et al, 1974). Vitamin C is best given in the appropriate food source.

While rest homes and residential homes used placebos, more private hospitals tended to use drug-free days as a means of rationalising drug therapy. The use of drug-free days suggests that patients have suffered from adverse reactions, but these have not been recorded in the patient records. As size of residence increased drug-free days as an intervention decreased, this may indicate there is an optimal size

for an institution to be most therapeutically operated. The subjects were taking more drugs than the mean, i.e., 4-6 and the drug classes most commonly implicated in adverse reactions were represented, i.e., cardiac glycosides, diuretics, laxatives, psychotropics and analgesics.

5. REPEAT AND PRN PRESCRIPTIONS

While placebos and drug-free days reduce the use of drug therapy, repeat prescriptions increase drug therapy by encouraging the use of medication long after the reason for prescription has passed. Repeat prescription also causes the adding to a regimen, without deletion, drugs with similar pharmacological action (Ingman et al, 1975). The use of PRN prescribing diffuses responsibility from the prescribing doctor to the nursing staff or patient to take when warranted (Ingman et al, 1975).

For enlightened nursing staff this may result in less use than the doctor intended, but an instruction which gave precise conditions under which the drug was to be administered would be preferable. Where the nursing staff are using prescriptions for the good of the institution, i.e., by reducing unwanted behaviour, then the doctor encourages this practice by using PRN

prescriptions. The high rate of PRN prescription of laxatives in rest homes could encourage their use rather than attending to the dietary and exercise needs of the elderly.

While the PRN instruction for the community sample prescribed psychotropics probably results in non-compliance, the PRN instruction in private hospitals is likely to mean the drug is given regularly. Reiken et al (1982) reported 40% of their community sample non-compliant with psychotropic medication. Although most non-compliance is in the direction of under use, community samples may take laxatives, antacids, and analgesics to excess. The PRN instruction may be equated for some as less potent.

Two doctors involved with rest home resident care practiced a policy of no repeat prescribing. This accounted for most of the difference between residential level and doctor availability. It appeared that some institutionalised elderly were more fortunate than others in which doctors were available to them. In the study by Ingman et al (1975) a requirement by physicians to rewrite prescriptions every 30 days in a long-term care institution reduced the mean number of drugs prescribed per resident by 0.8 (from 2.1).

The finding that increasing age resulted in the increase of repeat prescriptions suggested "ageism" was

present at least in some institutions.

6. DIFFERENCES IN USE OF NIGHT SEDATION

Whereas overseas studies report flurazepam as the most prescribed drug for sleep in this study nitzazepam and triazolam were the drugs of choice. Although benzodiazipines were most prescribed there was high use of antidepressants (doxepin) and neuroleptics (thioridazine). The benzodiazepines usually chosen are those with short duration of action, other drug classes such as antidepressants and neuroleptics are given as night sedation in a single dose where there is psychiatric illness present. From the prescription of these drugs in the institutions there appears to be present an alarming level of depression and psychiatric illness. Private hospitals used more individual drugs within the drug classes than did rest or residential homes. The overall frequency of drug prescription did not vary significantly over residential level, yet there was a significant difference in the prescription of night sedation over residence. In the community, 28% of subjects received night sedation, 46% of residential home residents, 49.8% of rest home residents were taking night sedation, and 63.5% of private hospital patients were prescribed night sedation. As there was a progression of use of night sedation with increase in

level of care, there was evidence for old people being "switched off" with the lights as Evans et al (1972) reported.

The strength of nitrazepam was examined over residence. The 5mg or higher dose was prescribed in 94% of cases, with 2.5mg prescribed to 6%. Residential homes used more of the lower dose and private hospitals more of the higher dosage. Williamson (1978) reported that 5mg is sufficient to cause hang-over effects and that 10mg is almost always too much. Many of the elderly in this study are likely to be suffering hang-over effects especially with concurrent prescription of other psychotropic drugs with sedating effects.

7. DIFFERENCES IN DRUG PRESCRIBING WITH RESIDENCE

The use of digoxin followed the expected pattern with usage increasing slightly across residence and being used more within the 85+ age group. However, the lack of review is of concern as it is a drug which carries one of the highest rates of adverse reactions. A report by Dall (1970) showed that from a group on long-term therapy 75% suffered no harm from stopping it.

The rate of Parkinson's disease is high at 7% of the total. It is a disease more commonly seen in the

very old and early onset may be an indicator that some cases were drug induced (Murdoch,1983).

The usage of laxatives varied across residence. Their use was more prominent in all institutions than in the community. There was high within group variaton suggesting difference in living conditions for the residents. Some homes emphasised good diet and exercise, others relied more on laxatives and other medications. The high use of laxatives may have been, in some cases, due to the high use of psychotropic medication, which have a common side effect of constipation.

There were no statistically significant differences with the use of benzodiazepines. However, their prescription rate was high (30% of all subjects received them). The loss of anxiolytic effect through development of tolerance makes long term prescription of them counterproductive (Hockings, 1983).

The use of phenothiazines by 23% of the sample still appeared excessive even when compared to 43% reported by Ray et al (1980) who suggested that the use of antipsychotic drugs was now recommended by many authorities as best reserved for acute behavioural disorders in the institutionalised elderly. Even with the mentally ill long term use is not reccommended. A study by Risse and Barnes (1986) supported the

episodic nature of the behaviours being modified and concurred with intermittent use of medication.

Also the sex difference suggests that behaviour (wandering, agitation, aggressiveness) was viewed differently depending on the sex of the subject.

Thomsen et al (1983) reported in their study that tardive dyskinesia can occur with small doses and after brief use of neuroleptics, the high level of use, combined with the infrequent review practice made the prescription rate shown in this study, more alarming.

The prescription of antidepressants was significantly different for sex. While only 6.7% of males received them 17% of females received them. When institutionalised individuals lose independence at a time when they may also be coping with other major life events, such as bereavement therefore the development of depression is not surprising for either sex. Females may lose more than males if they have followed the traditional female role of housekeeping, suddenly all work is done for them and consequently they have little to foster and maintain high self-esteem. Unless they previously lived alone males generally do not lose so much so suddenly.

Few very old were prescribed antidepressants and over all age groups there was no significant difference across institutions but there was a significant difference between community and institution.

If the prevalence of depression is so high in institutions then change in the environment may be more appropriate than drug therapy. Indeed at such levels of use there is support for Thompson et al's (1983) suggestion that depression may be drug-induced.

8. DIFFERENCES WITHIN INSTITUTIONAL LEVEL

There were vast differences between homes within each category. There were differences in size, whether they were mixed sex or single and whether there was choice of doctor or not. However number of drugs prescribed, frequency of medication review, use of PRN prescribing, placebos and drug-free days gave some indication of the concern some institution staff and doctors had for their patients. The high use of combinations of psychotropic medication, and the high use of psychotrophic medication within particular homes tended to support the argument that it was the institutions' staff molding residents into the institutional routine rather than a concern for the individual resident. Ray et al (1980) reported this occurring and suggested it was not surprising to find high levels of antipsychotic drug use while there were no strict guidelines for usage. Ray et al (1980) found, as found in this study, none of the homes with

high usage were dedicated specifically to psychiatric care.

Salzman (1982) reported that the CNS anticholinergic toxic syndrome after administration of antidepressants as shown in the elderly, is sometimes misdiagnosed as a rapidly developing dementia or psychosis. The usual treatment is the addition of a neuroleptic, thereby adding to anticholinergic effects. In this study with such high rates of combinations of psychotropic drugs this is bound to have occured. Murdoch (1983) reported the expectation is that 40% of subjects on long term phenothiazine therapy develop signs of Parkinsonism. Although it is difficult to distinguish idiopathic from iatrogenic Parkinsonism, high usage of phenothiazines make iatrogenic Parkinsonism highly probable within this study.

CHAPTER VI

CONCLUSIONS

With the elderly forming an increasing proportion of our society there is urgent need for service planning in this area. There needs to be a halt in increases in the provision of institutional beds and increased resources provided for the community care of the elderly. This study has shown that the provision of a District Nursing service promotes better health through supervisory care as well as a nursing service. There was both more review of medication in this group and more reporting of adverse reactions.

The high rate of drug prescriptions to this population is documented again with this study. The cost to this country is immence in financial terms but also in terms of wasted human resources if over prescription is causing iatragenic illness as this study would suggest is likely. Lamy (1986) reports that the most important requirement for maintaining independence is mental acuity, yet many drugs prescribed cause side effects such as delirium, acute confusion states, anxiety, depression, insomnia, and sedation that interfere with this requirement. These drugs are not new and untried but are drugs commonly

prescribed such as diuretics, analgesics, antihistamines, antiparkinsionian agents, antidepressants, beta blockers, other cardiovascular drugs, neuroleptics and digitalis.

Drug therapy should never be used as a substitute for time spent in advising or planning simple adjustments to daily living. The health professional should be aware that problems with adaptation to physical, psychological and social environments can be expressed in terms of symptoms. To avoid inappropriate institutionalisation, new ways to cope with these, must be developed. Multi-disiplinary input is essential with district nurses, physiotherapists, occupational therapists, social workers and psychologists all having important contributions to make.

There is need for ongoing research into pharmacokinetics and pharmacodynamics. There is need for more research to differentiate physiologic aging from pathologic proceses in old age. There are few data from individual human subjects followed over long enough time frames. There should be inclusion of geriatic patient groups in all stages of new drug testing to provide adequate information for doctors and patients alike.

There is an urgent need for further education. Educating the elderly to take more responsibility

for their own health and to question their doctors regarding the purpose of prescribed medication should be high on the priority list. They need to understand that modern drugs have a potency beyond that of anything available in their youth and that OTC drugs may be as potent as prescription drugs. Carers of the elderly should learn that therapy other than drugs may be the appropriate treatment and not pressure doctors to prescribe. Doctors should learn to resist the pressure from the patient, the patient's relative or drug company advertising to prescribe.

More research into changed sleep patterns of the elderly is required, as well as education programmes to teach the elderly to accept changed sleep patterns. It has been stated that a person who has difficulty filling the day is bound to find sleep elusive (Hockings, 1983).

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APPENDIX 1

Date: _____ Patient Code: _____
Researcher: _____ Age_____ Sex: _____
Informant: _____ Institution: _____
Years Institutionalised: _____
Community: _____

Code a-z	Drug	Dose strength	Medication e.g bd,tds	Reason for	Adverse React. noted	Rep 1mth 3mth	Drug free days

Community Sample: Over the Counter Drugs

Code	Drug	Dose	Frequency of use	Reason for taking

APPENDIX II

COMPLIANCE - COMMUNITY SAMPLE

1. Outdated medications (list):_____

_____

2. Labelling - adequate:_____
   (Use code - inadequate (a) take as required:_____
   a-h) (b) take as directed:_____
   (c) small print:_____
   (d) safety lids:_____
   (e) blister packs:_____
   (f) no instructions:_____
   (g) other's medication:_____
   (h) other (specify):_____

3. Time since last consultation with G.P.

   1 week_____2 week_____1 month_____3 month_____
   6 months_____1 year_____

4. Are you taking all your medications ?_____

   If not, why not ?_____

5. Have you discussed the ailment for which OTC's are taken with your G.P. ?_____

   Have you followed his/her advice ?_____

CHECK FOR PATIENT UNDERSTANDING

Drug	Dose	Medication frequency	Purpose